

## 日本産ワセンチュウ科の分類学的研究(4)

誌名	農業環境技術研究所報告
ISSN	09119450
著者	皆川, 望
巻/号	9号
掲載ページ	p. 53-152
発行年月	1993年3月

農林水産省 農林水産技術会議事務局筑波事務所  
Tsukuba Office, Agriculture, Forestry and Fisheries Research Council Secretariat



[Bull.Natl.Agro-Environ.  
Sci., 9, 53-152 (1993)]

## Taxonomic Studies of Criconematidae (Nematoda: Tylenchida) of Japan IV. Genus *Ogma* : Part 2

Nozomu MINAGAWA\*

(Received December 7, 1992)

### SYNOPSIS

Twelve species of *Ogma* (*in part.*) including seven new, two newly recorded (*O. centone* and *O. menzeli*) and three known (*O. octozonale*, *O. dryum* and *O. abies*) species from Japan are described and illustrated for their adult- and juvenile stages, and some comments are given on the taxonomic position of *O. japonicum*. *O. nemorosum* n.sp., closely related to *O. cobbi*, has smaller numbers of body annuli (47-54 vs. 57-65) and smooth second-head annule. *O. altum* n.sp. has smaller numbers of body annuli than *O. procive* (53-63 vs. 67-74) and longer stylet (99. 0-120. 5  $\mu\text{m}$  vs. 68. 7-80. 7  $\mu\text{m}$ ). *O. validum* n.sp., closely related to *O. fimbriatum*, has smooth first-head annule, more slender body scales and shows characteristic lip shape in face. *O. yambaruense* n.sp., related to *O. dryum*, has smooth first-head annule, more slender body scales and characteristic lip structure. *O. segmentum* n.sp. has larger number of body scales per annule than *O. menzeli* (46-76 vs. 52-60), and not spined but crenate in the first-head-annule. *O. prini* n.sp. is close to *O. segmentum* but separated from it by smooth first-head-annule and presence of submedian lobes in face. *O. microrodorum* n.sp. differs from *O. velutinum* in shorter stylet (40. 3-51. 3  $\mu\text{m}$  vs. 75-78  $\mu\text{m}$ ) and longer body scales. *O. capitospinosum* and *O. villifera* are synonymized with *O. abies*.

### Contents

Synopsis .....	53
Introduction .....	54
Descriptions of species .....	54
1. <i>Ogma nemorosum</i> n.sp. ....	54
2. <i>O. centone</i> (EROSHENKO, 1980) RASKI & LUC, 1987 .....	58
3. <i>O. octozonale</i> (MOMOTA & OHSHIMA, 1974) SIDDIQI, 1986 .....	61
4. <i>O. japonicum</i> (MINAGAWA, 1984) SIDDIQI, 1986 .....	64
5. <i>O. altum</i> n.sp. ....	65
6. <i>O. validum</i> n.sp. ....	68
7. <i>O. dryum</i> (MINAGAWA, 1979) RASKI & LUC, 1987 .....	71
8. <i>O. yambaruense</i> n.sp. ....	75
9. <i>O. abies</i> (ANDRÁSSY, 1979) RASKI & LUC, 1987 .....	78
10. <i>O. segmentum</i> n.sp. ....	83

\*Laboratory of Nematology and Soil Zoology, Division of Microbiology, Department of Environmental Biology,  
National Institute of Agro-Environmental Sciences, 3-1-1 Kannondai, Tsukuba, Ibaraki, 305 Japan.

11. <i>O. prini</i> n.sp. ....	86
12. <i>O. menzeli</i> (STEFANSKI, 1924) SCHUURMANS STEKHoven & TEUNISSEN, 1938 .....	89
13. <i>O. microdorum</i> n.sp. ....	93
Discussion .....	96
Acknowledgments .....	98
References .....	98
Synopsis in Japanese .....	101
Tables .....	102
SEM photographs .....	119

## INTRODUCTION

During and after the preparation of the third part of this series, two important contributions to Tylenchina classification appeared. One is the work done by SIDDIQI (1986) from the view point of phylogenetic systematics, and the other is by LUC and others from the view point of evolutionary taxonomy (LUC *et al.*, 1987; RASKI & LUC, 1987). In short, SIDDIQI's system can be called as a "splitter's" one, and RASKI and LUC's system a "clumper's" one. Although their classification systems are partly identical but considerably different in some parts; their classification systems are far from each other in the category of such taxa as genera, subfamilies and families, and their names used for the family Criconematidae. Some arguments on SIDDIQI's system had been given in my previous paper (MINAGAWA, 1988).

In the present paper, 13 species of Criconematidae are reported from Japan under the name of *Ogma* (*sensu* RASKI & LUC, 1987, *in part.*). These are able to be classified into the species of *Ogma* (*Seriespinula*) and *Crossonema* (*Neocrossonema*) : *sensu* SIDDIQI (1986). Out of 13 species, seven are new to science and two are new to Japan, three are already known in our country, and one, being described as *Pseudocriconema japonicum* in the previous part of this series (MINAGAWA, 1988), was that some comments are given on it as a species of *Ogma*. Except for *O. japonicum*, 12 species are described and illustrated for their adults and juvenile stages. Method of study employed and abbreviations used were shown in the first part of this study (MINAGAWA, 1986).

## DESCRIPTIONS OF SPECIES

### 1. OGMA NEMOROSUM N.SP.

**Measurements.** Shown in Table 2 (female adult) and Table 3 (juvenile stages).

**Descriptions.** *Female adult* (Figs. 1, 69, 133-135, 163, 181, 202, 217, 218; Table 2). Body long and stout, cylindrical (Figs. 1, 69); 337-491  $\mu\text{m}$  long; almost straight or slightly curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and regularly decreasing the width towards pointed tail terminus in the posterior third of body. Body annuli coarse, 47-52 (rarely 45 or 54) in number, with 12-16, rarely up to 22 longitudinal rows of scales in mid-body and decreasing in number near posterior terminus (Fig. 69). Scales of first few body annuli small semicircular to triangular in shape, with bluntly pointed tip, arranged partly continuous fringe but irregular intervals

(Fig. 163). Scales of mid-body annuli triangular, with rounded tip, or rectangular in shape, occasionally bifurcate on tip, 4. 9-8. 2  $\mu\text{m}$  long, variable in width at base in mid- and posterior body (Figs. 69, 181); smaller scales occasionally present between rows, especially on the posterior half of body in some paratypes.

Head annuli two, set off (Fig. 163); first one waved and crenate, directed laterally and anteriorly; second one smaller than the first (Mt. Norikura and Mt. Yokodake populations) or equal in diameter (Nakakaruizawa and Kusatsu populations), smooth and collar-like. Labial disk oval; oral opening I-shaped; labial sectors equal in size and shape, arranged in hexagram around oral disk (Figs. 133-135). Stylet thin and flexible, 86. 6-108. 0  $\mu\text{m}$  long; knobs anchor shaped, 2.4-4.1  $\mu\text{m}$  high and 6. 6-9. 0  $\mu\text{m}$  across.

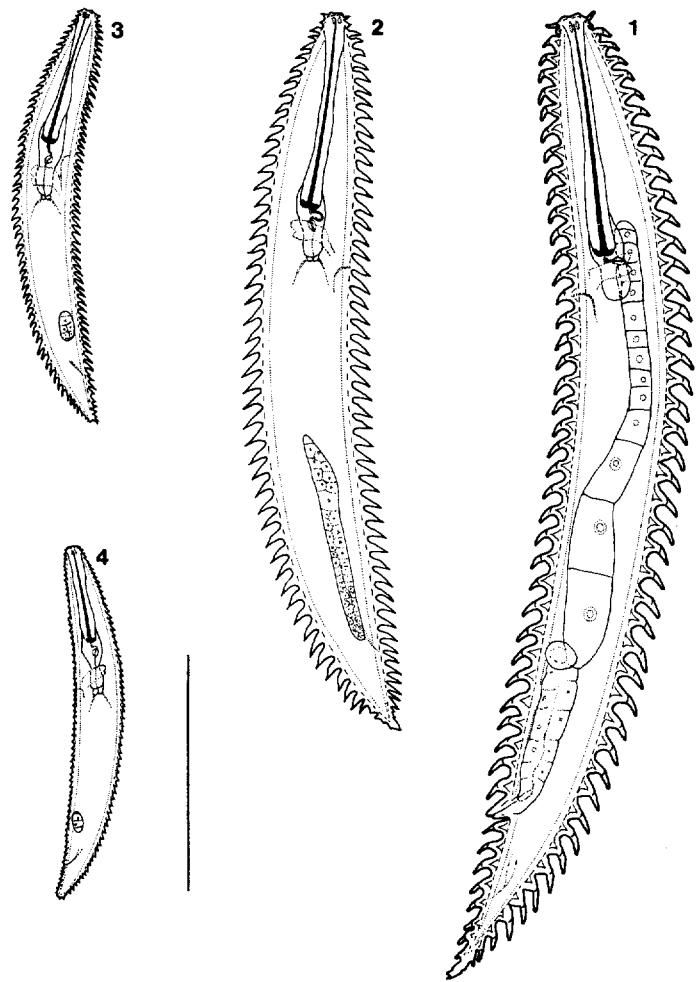
Excretory pore around the level of esophagus end; on 14th-19th annule and 99. 0-154. 7  $\mu\text{m}$  from anterior end. Reproductive system well developed (Fig. 1); ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded, without spermatozoa; vagina slightly sigmoid. Vulva usually on 9th-13th annule from tail end; anterior vulval lip prominent, semicircular to rectangular, sometimes triangular and notched at the center of front edge, overhanging posterior one; posterior lip semicircular, and broader than anterior one (Fig. 202). Tail conical, usually with six to eight, rarely four or five annuli, 21. 4-37. 9 (30. 7 $\pm$ 4. 4)  $\mu\text{m}$  long; terminus drawn out (Figs. 217, 218).

*Male adult.* Not found.

*Fourth-stage juvenile* (Figs. 2, 95, 257-260; Table 3). Body stout and spindle shaped (Figs. 2, 95); almost straight to slightly curved ventrally; 229-365  $\mu\text{m}$  (mean = 287  $\mu\text{m}$ , n = 10) long, with 52-56 annuli; bearing 10 or 11, rarely 12 longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales triangular in shape, 4. 9-10. 7  $\mu\text{m}$  (7. 5) long and 5. 7-9. 9  $\mu\text{m}$  (8. 0) wide at base; tip and both sides near tip of each scale with three to five minute appendages, spine-like in shape, variable in length (Fig. 259); these appendages similar in size and more in number in anterior body (Fig. 258) than those of other part of body.

Head annuli two, set off, directed anteriorly and laterally (Fig. 258); first annule distinctly crenate, with mostly rounded, occasionally pointed teeth on outer edge, 9. 9-13. 2  $\mu\text{m}$  (12. 4) in diameter; second one crenate, 11. 5-15. 6  $\mu\text{m}$  (13. 7) across, larger than the first. In face view, oral disk oval; pseudolips convex, six in number, arranged in hexagram, similar in shape and size each other, enclosing oral disk (Fig. 257). Stylet thin, 69. 3-80. 0  $\mu\text{m}$  (75. 6) long; knobs anchor shaped, occasionally absent (one out of ten juveniles examined). Genital primordium elongated, 54. 4-95. 7  $\mu\text{m}$  (71. 3) in length. Tail conical, 23. 1-36. 3  $\mu\text{m}$  (33. 7) long, with eight to ten annuli, terminus bluntly pointed (Fig. 260).

*Third-stage juvenile* (Figs. 3, 109, 325-328; Table 3). General shape and surface ornate-ments are similar to the fourth-stage juvenile; but body smaller, 163-185  $\mu\text{m}$  (mean = 172  $\mu\text{m}$ , n = 10) long, with more annuli (56-68); stylet shorter (48. 7-61. 3  $\mu\text{m}$ ); knobs smaller; genital primordium less developed, oval shaped, 10. 0-14. 0  $\mu\text{m}$  (12. 4) long and 5. 0-6. 7  $\mu\text{m}$  (5. 7) wide.



Figs. 1-4. *Ogma nemorosum* n.sp.: 1. Female adult; 2. Fourth-stage juvenile; 3. Third-stage juvenile; 4. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

*Second-stage juvenile* (Figs. 4, 110, 373-376; Table 3). Body small, 143-164  $\mu\text{m}$  (mean = 151  $\mu\text{m}$ , n = 10) long and spindle shaped, with 58-73 annuli (Figs. 4, 110). Body scales minute, triangular or semicircular, ca. 0.6  $\mu\text{m}$  wide at base and ca. 0.3  $\mu\text{m}$  long in mid-body, the tip pointed or with teeth, three to five in number on each front by SEM observation, partly arranged in longitudinal, and/or alternate rows, but mostly scatter, 14-22 (17.8) per annule (Fig. 375).

Head annuli two, not set off; first one 6.7-8.0  $\mu\text{m}$  (7.1) in diameter, directed posteriorly and laterally, outer margin slightly crenate; second one directed posteriorly, crenate, larger than the first (Figs. 373-374). Stylet slender, 37.3-46.0  $\mu\text{m}$  (40.1) long, with anchor shaped knobs. Genital primordium oval, with two cells, 6.0-10.0  $\mu\text{m}$  (7.5) long and 4.3-6.0  $\mu\text{m}$  (4.6) wide. Tail conical, with seven or eight annuli, terminus bluntly pointed (Fig. 376).

**Type specimens.** Holotype female is deposited in the Herbarium and Insect Museum of the National Institute of Agro-Environmental Sciences (NIAES) in Tsukuba, Ibaraki. Paratypes: 79 females and 52 juveniles. Paratypes of two females will be distributed to the following each institutes; USDA Nematode Collection, Beltsville, Maryland, U.S.A. (USDANC); University of California, Nematode Survey Collection, Davis, California, U.S.A. (UCDNC); Nematology Department, Rothamsted Experimental Station, Harpenden, Herts., U.K. (DNRES); Department of Nematology, Agricultural University, Wageningen, The Netherlands (DNLW); Instituut voor Dierkunde, Rijksuniversiteit Gent, Gent, Belgium (IDRUG); and Laboratoire de Biologie Parasitaire, Muséum National d'Histoire Naturelle, Paris, France (LPMNHN). The remaining paratypes are on deposit in NIAES.

**Type locality and habitat.** Holotype and paratypes were obtained from rhizosphere of the following plants and localities; *Ilex crenata* var. *paludosa* (NAKAI) HARA, *Prunus* (*Cerasus*) sp., *Rhododendron japonicum* (A. GRAY.) SURINGER and *Betula platyphylla* var. *japonica* (MIQ.) HARA in Mt. Norikura, Nagano; *Abies Veitchii* LINDLEY and *Betula Ermanii* CHAM. in Mt. Yatsugatake (on the Lake Shirakoma-ike), Nagano; *Fagus crenata* BLUME in Nakakaruizawa, Nagano; *Quercus dentata* THUNB. and an unidentified woody plant in Kusatsu, Gunma.

**Diagnosis and relationships.** *O. nemorosum* n. sp. distributes in the montane to subalpine zone of the central Honshu. This species is characterized as follows. Female 335-491  $\mu\text{m}$  long, with 45-54 annuli. Body scales triangular with rounded tips to rectangular, arranged in usually 12-16, rarely 18-22 longitudinal rows in mid-body, and additional small scales sometimes present between rows. First head annule crenate on outer edge, distinctly or slightly larger than the second, which in smooth. Face with six well developed lips. Stylet 86.6-108.0  $\mu\text{m}$  long. Vulva on 9th-13th annule from terminus. Spermatheca without spermatozoa. Tail elongated conical, with four to eight annuli, terminus drawn out. Scales of juvenile (fourth stage) bluntly pointed triangular, with sharply-pointed minute-spines on each near the tip.

This new species is similar in the shape and arrangement of body scales to *O. cobbi* (MICOLETZKY, 1925) SIDDIQI, 1986, *O. centone* (EROSHENKO, 1980) RASKI & LUC, 1987 and *O. allieri* (DOUCET, 1981) RASKI & LUC, 1987 (Figs. 69, 70). This can be distinguished from *O. cobbi* by the smaller number of body annuli (R=57-65 in *O. cobbi*), smooth-edged second-head-annule

of female (MICOLETZKY, 1925; MEHTA & RASKI, 1971; ANDRÁSSY, 1979; CASTILLO *et al.*, 1990), and shape and spination of body annuli of juveniles (EBSARY, 1981); from *O. centone* by usually lesser number of scale rows (12-34 in *O. centone*) in female, and shape and spiny appendages of body scales of juvenile stages (EROSHENKO, 1980; this issue); from *O. allieri* by the larger number of scale rows (10 in *O. allieri*) and smaller numbers of body annuli (57-61 in *O. allieri*) (DOUCET, 1980).

## 2. OGMA CENTONE (EROSHENKO, 1980) RASKI & LUC, 1987

**References.** EROSHENKO, 1980, p. 107, fig. 2 (*Crossonema*); SIDDIQI, 1986, p. 379 (*Crossonema (Neocrossonema)*); RASKI & LUC, p. 414 (*Ogma*); EBSARY, 1991, p. 65 (*Ogma*).

**Measurements.** Shown in Table 4 (female adult) and Table 5 (juvenile stages).

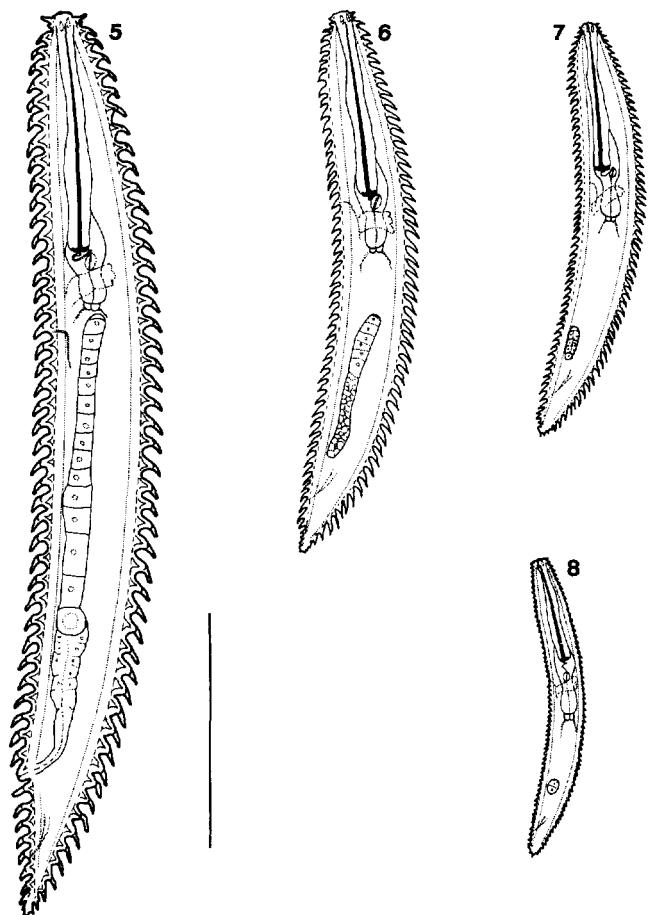
**Descriptions.** *Female adult* (Figs. 5, 70, 136-138, 164, 182, 183, 203, 219, 220; Table 4). Body stout, cylindrical (Figs. 5, 70); 364-492  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; gradually tapering towards head in esophagus region in anterior body; and regularly decreasing the width towards pointed tail terminus in postvulval part of body. Body annuli course, 46-54 in number, each bearing a fringe of scales (Fig. 70). Scales varying in shape, *i.e.*, digitate, spatulate, triangular, rectangular or rarely bifurcate on tip and also in length and width even in a single female; mostly arranged in longitudinal rows, but partly scatter and irregular intervals, 2.4-7.2  $\mu\text{m}$  in width and 4.9-10.6  $\mu\text{m}$  in length (Figs. 182, 183); 12-30 per annule in mid-body, decreasing in number towards the tail terminus, where scales more slender than those of mid-body (Fig. 70).

Head annuli two, set off (Fig. 164); first one directed anteriorly and laterally, crenate in outer edge, with rounded and minute teeth, 32-38 (mean = 35.4, n = 5) in number, which irregular in size; second one directed laterally, smaller than the first, roughly crenate. In face view, oral opening I-shaped; labial disk rounded square, enclosed in dorsal and ventral portion by connected pseudolips, which slightly swelling submedially; lateral lobes semi-circular, weakly developed (Figs. 136-138). Stylet thin and flexible, 93.6-111.5  $\mu\text{m}$  long; knobs anchor shaped, 2.4-4.1  $\mu\text{m}$  high and 7.4-9.0  $\mu\text{m}$  across.

Excretory pore on 15th-19th annule and 118.8-160.0  $\mu\text{m}$  from anterior end, or at the same level or a few annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded to oval, without spermatozoa; vagina straight (Fig. 5). Vulva on 10th-12th annule from tail end; anterior lip small, broad triangular to semicircular, not strongly overhanging posterior one (Fig. 203); posterior one shallow semicircular, broader than the anterior one. Tail conical, with usually four to six, rarely seven or eight annuli, 17.3-44.0  $\mu\text{m}$  long, terminus not strongly drawn out but pointed (Figs. 219, 220).

*Male adult.* Not found.

*Fourth-stage juvenile* (Figs. 6, 94, 261-264; Table 5). Body stout and spindle shaped (Figs. 6, 94); almost straight to slightly curved ventrally; 239-274  $\mu\text{m}$  (mean = 249  $\mu\text{m}$ , n = 10) long with 52-57 annuli (54.1); bearing ten longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales triangular in shape, 6.5-9.8  $\mu\text{m}$  (8.5) long and



Figs. 5-8. *Ogma centone* (EROSHENKO, 1980): 5. Female adult; 6. Fourth-stage juvenile; 7. Third-stage juvenile; 8. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

6.9-7.3  $\mu\text{m}$  (6.3) wide at base; tip and both sides of each scale with three to six minute appendages, which triangular in shape (Fig. 263).

Head annuli two, set off, directed laterally (Fig. 262); first one distinctly crenate, with sharply pointed teeth on outer margin, 22-27 (mean = 25.0, n = 5) in number, 10.6-13.0  $\mu\text{m}$  (12.1) in diameter; second one 11.4-13.8  $\mu\text{m}$  (12.6) across, larger than the first and margin more distinctly pointed. In face view, oral disk rounded square; enclosed in dorsal and ventral portion by connected pseudolips, which six in number (Fig. 261). Stylet thin, 74.9-83.8  $\mu\text{m}$  (78.9) long; knobs anchor shaped. Excretory pore on 19th-21st annule from lip. Genital primordium elongated, 47.2-70.7  $\mu\text{m}$  (64.5) in length. Tail conical, 18.7-26.0  $\mu\text{m}$  (22.9) in length, with five to seven annuli, terminus bluntly pointed (Fig. 264).

*Third-stage juvenile* (Figs. 7, 111, 329-332; Table 5). General shape and surface ornate-ments are similar to the fourth-stage juvenile; but body smaller, 150-231  $\mu\text{m}$  (mean = 185  $\mu\text{m}$ , n = 10) long, with 53-59 annuli (59.1); stylet shorter (54.5-63.5  $\mu\text{m}$ ); knobs smaller; genital primordium less developed, oval shaped, 11.4-18.7  $\mu\text{m}$  (14.9) long and 4.9-7.3  $\mu\text{m}$  (6.0) wide.

*Second-stage juvenile* (Figs. 8, 112, 377-380; Table 5). Body small, 129-146  $\mu\text{m}$  (mean = 139  $\mu\text{m}$ , n = 4) and spindle shaped, with 62-63 annuli (Figs. 8, 112). Body scales minute, triangular or semicircular, with minute spines on each tip, 1.3-2.0  $\mu\text{m}$  (1.6) long and 1.3-2.3  $\mu\text{m}$  (1.9) wide, partly arranged in longitudinal and/or alternate rows but mostly scatter, 15-18 (16.3) per annule in mid-body (Fig. 379). Head annuli two (Figs. 377, 378); first one 6.5-7.8  $\mu\text{m}$  (7.1) in diameter, directed posteriorly and laterally, outer margin slightly crenate; second one directed posteriorly, crenate, larger than the first (7.5-9.1  $\mu\text{m}$  (8.2)). Stylet slender, 41.7-44.3  $\mu\text{m}$  (43.0) long, with anchor shaped knobs. Genital primordium oval, with two cells, 6.5-8.5  $\mu\text{m}$  (7.7) long and 4.2-4.6  $\mu\text{m}$  (4.5) wide. Tail conical, with seven to nine annuli, terminus bluntly pointed (Fig. 380).

**Specimens examined.** *O. centone* was obtained from rhizosphere of the following plants and localities; *Abies sachalinensis* (FR. SCHMIDT) MASTERS in Nopporo, Hokkaido; *Prunus (Cerasus)* sp. and an unidentified woody plant in Mt. Sapporo, Hokkaido; *Weigela hortensis* (SIEB. & ZUCC.) KOCH, *W. Middendorffiana* (CARRIERE) K. KOCH, *Kalopanax pictus* (THUNB.) NAKAI, *Acanthopanax sciadophylloides* FR. & SAV., *Acer Tschonoskii* MAXIM., *Prunus (Cerasus)* sp., *Sorbus americana japonica* (MAXIM.) KITAMURA, *Alnus crispa Maximowiczii* (CALL.) HULT. and *Betula platyphylla* var. *japonica* (MIQ.) HARA in Mt. Eniwa, Hokkaido.

**Remarks.** *O. centone* was described from Siberia by EROSHENKO (1980), and is newly recorded from Japan in this paper. In Japan, this species detected mainly from the montane to subalpine zone in Hokkaido, but not in Honshu and other main islands, where *O. nemorosum* n.sp. is detected instead of *O. centone*. Morphology and dimensions of both Siberian and Japanese populations are well agreed.

This species is characterized as follows. Female body 364-515  $\mu\text{m}$  long, with 46-54 annuli. Body scales rectangular to digitate, roughly arranged in longitudinal rows, 12-34 in number in mid-body. The first head annule larger than the second, both crenate. In face view, oral disk enclosed by rims, which consisted with fused lips. Stylet 93.6-111.5  $\mu\text{m}$

long. Vulva on 9th-12th annule from terminus. Spermatheca without spermatozoa. Tail conical, with five to eight annuli, terminus pointed. Body scales of juvenile (fourth stage) trapezoid, with triangular minute-spines on each tip.

*O. centone* is most closely related to *O. cobbi* and *O. nemorosum* n. sp. by the shape and arrangement of body scales, and morphology of head annuli (MICOLETZKY, 1925; MEHTA & RASKI, 1917; LOOF, 1988; EROSHENKO, 1980; this issue). This species differs from *O. cobbi* by the smaller numbers of body annuli ( $R = 57-65$  in *O. cobbi*), and not neatly arranged in longitudinal rows of body scales; from *O. nemorosum* n.sp. by the characters mentioned in its "Diagnosis and relationships" of that species in this paper.

Dimensions of the two Japanese populations shown in Table 4 are well corresponding each other and also with those of Siberian population given in the original description (EROSHENKO, 1980), but comparing with the dimensions of Siberian population those of the Japanese populations are larger in Ran (4-7 vs. 4-5), Rex (15-19 vs. 14-16), RSt (12-18 vs. 11-12) and ROes (15-21 vs. 13-15); or smaller in RVan (3-5 vs. 5). These are partly overlapped, and considered to be intraspecific variations.

### 3. OGMA OCTOZONALE (MOMOTA & OHSHIMA, 1974) SIDDIQI, 1986

**References.** MOMOTA & OHSHIMA, 1974, p. 47-50, fig. 1 A-K, a A-E (*Crossonema (Seriespinula)*); KHAN, CHAWLA & SAHA, 1976, p. 83 (*Seriespinula*); ANDRÁSSY, 1979, p. 40 (*Seriespinula*); EBSARY, 1981, p. 108 (*Seriespinula*); SIDDIQI, 1986, p. 369 (*Ogma (Seriespinula)*); RASKI & LUC, 1987, p. 415 (*Ogma*); EBSARY, 1991, p. 68 (*Ogma*).

**Synonym.** *Crossonema (Seriespinula) sokliense* CHOI & GERAERT, 1975: CHOI & GERAERT, 1975, p. 42-44, fig. 5 A-G; ANDRÁSSY, 1979, p. 40 (*Seriespinula*); EBSARY, 1981, p. 108 (syn.).

**Measurements.** Shown in Table 6 (female adult) and Table 7 (juvenile stages).

**Descriptions.** *Female adult* (Figs. 9, 71, 72, 139, 140, 165, 184-186, 204, 221-223; Table 6). Body stout, cylindrical to spindle shaped (Figs. 9, 71, 72); 337-486  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards pointed tail terminus in postvulval part of body. Body annuli course, 54-62 (mostly 56-60) in number, with usually eight, occasionally nine (Fig. 71), rarely seven longitudinal rows of scales in mid-body, decreasing row numbers towards the posterior terminus (Figs. 71, 72). Scales spine-like on the first body annule; fork-like shape, usually divided into two to four from the second body annule to near vulva, 4. 9-12. 3  $\mu\text{m}$  long and 6. 6-13. 2  $\mu\text{m}$  wide at base (Figs. 184-186); digitate in postvulval body (Figs. 71, 72).

Head annuli two, set off (Fig. 165); first one smooth in outer edge and crinkled, directed laterally and anteriorly; second one smaller than the first, smooth or slightly crenate. In face view, labial disk rounded square; oral opening I-shaped; pseudolips six, arranged in hexagram around oral disk, lateral sectors flat and broad; submedian lobes weakly developed (Figs. 139-140). Stylet thin and flexible, 99. 0-116. 3  $\mu\text{m}$  long; knobs anchor shaped, 2. 4-3. 3  $\mu\text{m}$  high and 6. 6-9. 0  $\mu\text{m}$  across.

Excretory pore on 19th-23rd annule (rarely 16th or 24th annule) and 117. 2-157. 9  $\mu\text{m}$  from anterior end, or around the level of esophagus end. Reproductive system well de-

veloped; ovary usually outstretched, reaching esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded, without spermatozoa; vagina slightly sigmoid (Fig. 9). Vulva usually on 10th-12th, rarely ninth or 13th annule from tail end; anterior vulval lip prominent, semicircular, overhanging posterior one; posterior one broad semicircular (Fig. 204). Tail conical, with usually five to seven, rarely three or eight annuli, 15.6-49.5  $\mu\text{m}$  long, terminus strongly drawn out and pointed (Figs. 219, 220).

*Male adult.* Not found.

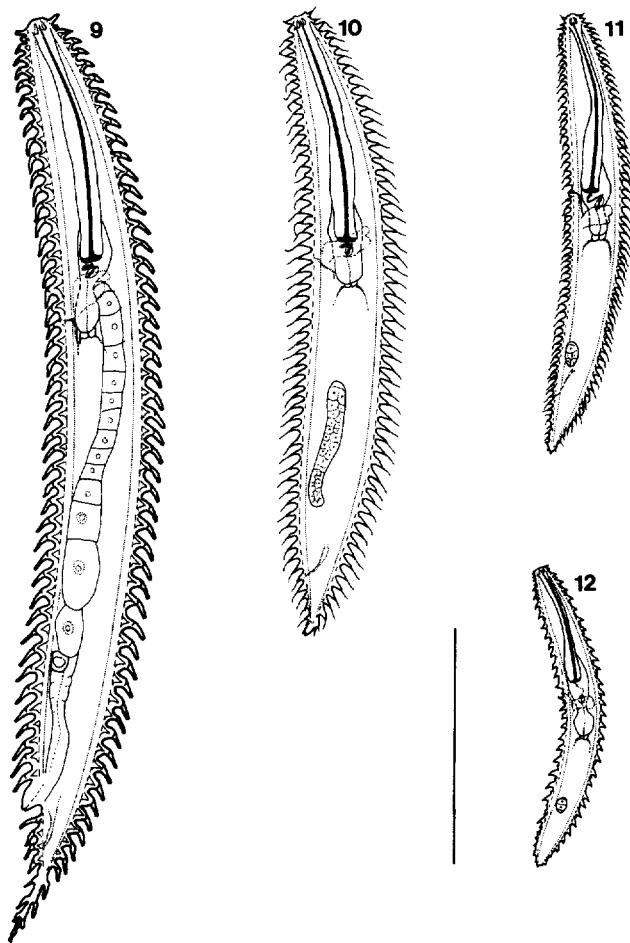
*Fourth-stage juvenile* (Figs. 10, 95, 265-268; Table 7). Body stout and spindle shaped (Figs. 10, 95); almost straight to slightly curved ventrally; 261-330  $\mu\text{m}$  (mean = 289  $\mu\text{m}$ , n = 10) long, with 57-66 annuli (61.9); bearing ten, rarely 11 or 12 longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales semicircular in shape with a membranous and broad foliate appendage on each tip; scale 6.7-8.7  $\mu\text{m}$  (7.5) long plus 4.0-7.0  $\mu\text{m}$  (5.6) long appendage, and 6.0-8.0  $\mu\text{m}$  (7.2) wide at base (Fig. 267).

Head annuli two, set off; first annule directed anteriorly and laterally, 11.3-15.3  $\mu\text{m}$  (12.4) in diameter, with foliate appendages 11-24 in number (17.0) on outer margin; second one almost equal to the first in diameter, 11.3-14.0  $\mu\text{m}$  (12.6) across, crenate with more slender appendages comparing to those of the first annule (Fig. 266). In face view, oral disk oval to rounded square; submedian lobes well developed (Fig. 265). Stylet thin, 84.7-100.3  $\mu\text{m}$  (95.0) long; knobs anchor shaped. Excretory pore on 22nd-27th annule from lip. Genital primordium elongated, 49.5-91.3  $\mu\text{m}$  (63.9) in length. Tail conical, 21.3-33.0  $\mu\text{m}$  (25.9) long, with six to nine annuli bearing large foliate appendages on each annule, terminus pointed (Fig. 268).

*Third-stage juvenile* (Figs. 11, 113, 333-336; Table 7). General shape and surface ornate-ments are similar to the fourth-stage juvenile; but body smaller, 157-198  $\mu\text{m}$  (mean = 185  $\mu\text{m}$ , n = 10) long; stylet shorter (68.9-79.2  $\mu\text{m}$ ); knobs smaller; genital primordium less developed, oval shaped, 9.3-12.7  $\mu\text{m}$  (10.6) long and 5.7-6.3  $\mu\text{m}$  (5.9) wide.

*Second-stage juvenile* (Figs. 12, 114, 381-384; Table 6). Body small, spindle shaped, 119-146  $\mu\text{m}$  (mean = 140  $\mu\text{m}$ , n = 10) long, with 60-69 annuli; bearing body scales arranged in alternate rows, eight or nine (8.2) in number per annule in mid-body (Figs. 12, 114). Body scales lobed, semicircular to triangular in shape, 3.0-4.3  $\mu\text{m}$  (3.5) long and 2.3-4.0  $\mu\text{m}$  (3.4) wide at base (Fig. 383). Head annuli two, directed posteriorly and laterally (Figs. 381, 382); first one 7.0-8.0  $\mu\text{m}$  (7.6) in diameter, outer margin smooth; second one crenate, larger than the first (8.0-9.0  $\mu\text{m}$ ). Stylet thin, 44.0-52.0  $\mu\text{m}$  (49.3) long; knobs smaller. Genital primordium oval, with two cells, 6.3-8.7  $\mu\text{m}$  (7.3) long and 4.3-5.3  $\mu\text{m}$  (4.8) wide. Tail conical, with six to ten annuli, terminus bluntly pointed (Fig. 384).

**Specimens examined.** *O. octozonale* is distributing in Kyushu, Shikoku and Honshu. This species was obtained from rhizosphere of the following plants and localities: *Quercus serratum* MURRAY in Nishigoshi, Kumamoto; *Pieris japonica* (THUNB.) D. DON, *Euonymus Sieboldianus* BLUME, *Sorbus japonica* (DECNE.) HELDLUND, *Hydrangea luteovenosa* KOIDZUMI, *Rubus palmatus* THUNB., *Lindera triloba* (SIEB. & ZUCC.) BLUME, *Quercus acutissima* CARR. in Mt. Aso, Kumamoto; *Quercus* sp. in Takamatsu, Kagawa; *Callicarpa japonica* THUNB., *Ilex latifolia* THUNB.



Figs. 9-12. *Ogma octozonale* (MOMOTA & OHSHIMA, 1974): 9. Female adult; 10. Fourth-stage juvenile; 11. Third-stage juvenile; 12. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

and *Quercus* sp. in Kotohira, Kagawa; *Chamaecyparis obtusa* (SIEB. & ZUCC.) ENDLICHER in Mt. Nijosan, Nara (T. MIZUKUBO leg.); *Quercus mongolica* var. *grosseserrata* (BL.) REHDER & WILSON in Misugi (Hirakura), Mie; *Larix Kaempferi* (LAMB.) CARRIERE in Mt. Meshimori, Nagano; *Ilex latifolia* in Fukuroi, Shizuoka; *Quercus serratum* in Moro, Saitama; *Styrax japonica* SIEB. & ZUCC., *Rhododendron japonicum* (A. GRAY) SURINGER, *Acer* sp., *Prunus Jamasakura* SIEB., *Lindera umbellata* THUNB., *Carpinus Tschonoskii* MAXIM. and an unidentified woody plant in Nishinasuno, Tochigi; *Quercus serrata* in Nishisenboku (Kariwano), Akita.

**Remarks.** *O. octozonale* widely distributes in Honshu, Shikoku and Kyushu, but was not detected in Hokkaido. CHOI and GERAERT (1975) reported this species from Korea as *Crossonema sokliense*, which has nine longitudinal rows of scales.

This species is characterized as follows. Female body 337-486  $\mu\text{m}$  long, with 54-72 annuli. Body scales bi-, tri-, or quadri-furcate, arranged in mostly eight, rarely seven (one out of 73 females examined) or nine (three out of 73 females) longitudinal rows in mid-body. Face with six pseudolips and weakly developed submedian lobes. First and second head annule smooth in outer edge, first one distinctly larger than the second. Stylet 99.0-116.3  $\mu\text{m}$  long. Vulva on ninth to 13th annule from terminus. Spermatheca without spermatozoa. Tail elongate conoid, with usually five to eight, rarely three or four annuli, terminus strongly drawn out and pointed. Body scales of juvenile (fourth stage) rectangular, with a large leaf-shaped appendage on each tip.

Some morphological differences are detected in females among Japanese populations (Table 6); such as Ran smaller in Nishisenboku population; RVan smaller in Mt. Aso population; Rex smaller and RSt larger in Mt. Hamishi population comparing to those of others. In addition, even in a single population, females bearing different numbers of scales rows are rarely detected as mentioned above. But in general the diagnostic characters are well fixed in this species.

This species most resembles to *O. venusta* (MEHTA & RASKI, 1971) SIDDIQI, 1986 as pointed out in the original description (MOMOTA & OHSHIMA, 1974), with the furcate scales and smooth head annuli. This species can be distinguished from it by the smaller number of body annuli ( $R=76-90$  in *O. venusta*) and lesser number of scale rows (ten in the latter) (MEHTA & RASKI, 1971).

#### 4. OGMA JAPONICUM (MINAGAWA, 1984) SIDDIQI, 1986

**References.** MINAGAWA, 1984, p. 374-381, fig. 1-3 (*Pseudocriconema*); SIDDIQI, 1986, p. 368 (*Ogma* (*Ogma*)); RASKI & LUC, 1987, p. 414 (*Ogma*); MINAGAWA, 1988, p. 143-145, figs. 36-41, 47, 56, 63, 102-112, 122-124, 130, 136, 145, 151, 156 (*Pseudocriconema*); EBSARY, 1991, p. 67 (*Ogma*).

**Remarks.** Descriptions and figures were presented as *Pseudocriconema japonicum* in the previous part of this series (MINAGAWA, 1988). Because of bearing the elongated and triangular shaped submedian lobes, genus *Pseudocriconema* MINAGAWA, 1984 was erected for this species (MINAGAWA, 1984). Although the well developed submedian lobes of this species are unique in genus *Ogma* (s.l.), these of *Ogma* spp. are variable among the species shown in

this paper. Juvenile scales are also closely related to those of *Ogma* spp. (= *Seriespinula*: *sensu* SIDDIQI, 1986). Owing to the above mentioned reasons, *Pseudocriconema* is referred to be a junior synonym of *Ogma* as pointed out by SIDDIQI (1986) and/or RASKI & LUC (1987) here, too.

### 5. OGMA ALTUM N.SP.

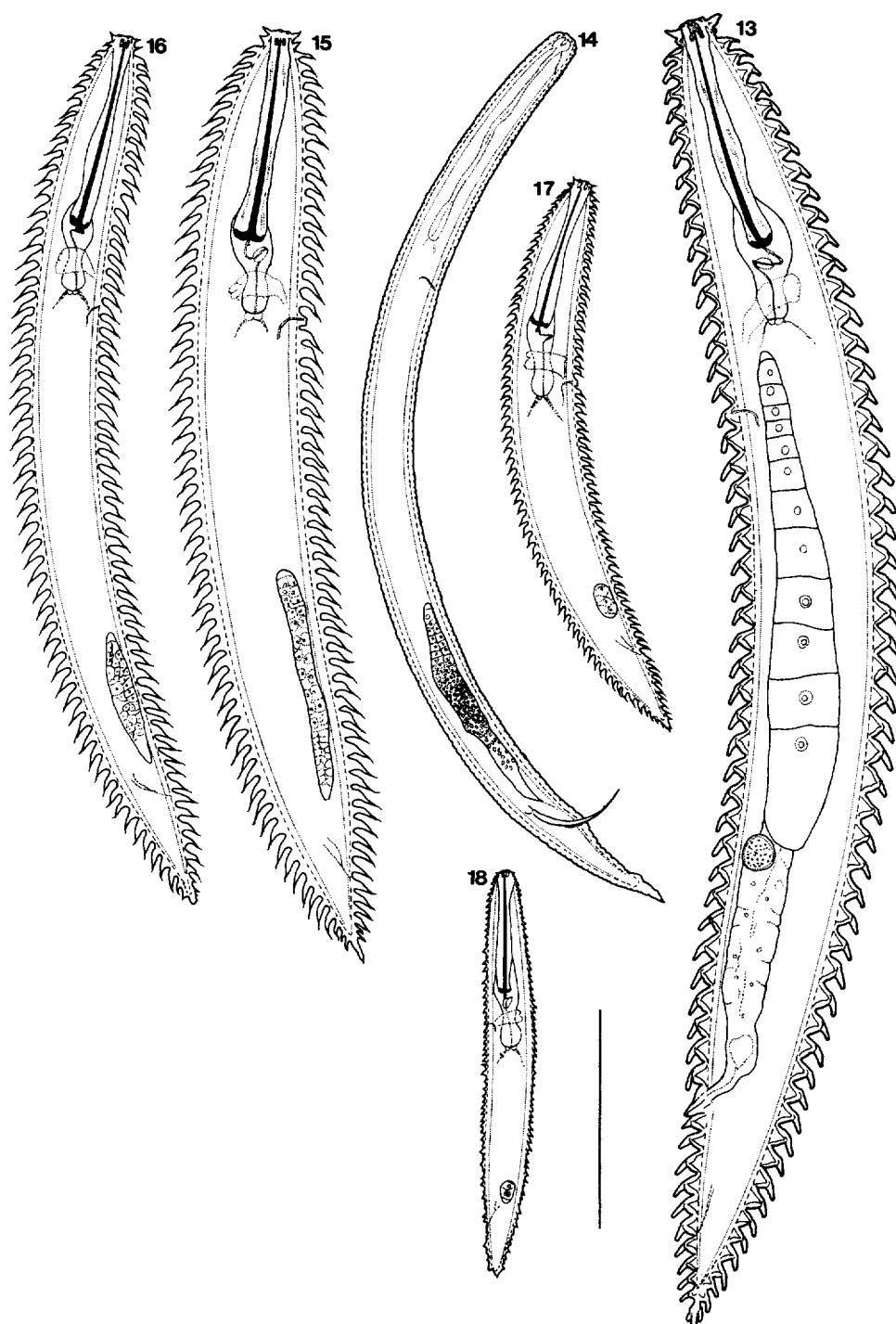
**Measurements.** Shown in Table 8 (female adult), Table 9 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 13, 73, 141, 142, 166, 187, 188, 205, 224-226; Table 8). Body long and stout, cylindrical (Figs. 13, 73); 431-645  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards pointed tail terminus in postvulval part of body. Body annuli coarse, 53-63 in number; each bearing a continuous fringe of scales (Fig. 73). Scales digitate or spatulate, variable in width even in a single female, 0.8-2.4  $\mu\text{m}$  wide and 6.5-9.9  $\mu\text{m}$  long; 52-68 per annule in mid-body, decreasing in number towards the tail terminus (Figs. 187, 188); by SEM observation, slightly directed outwards from body contour at the tip and neatly settled.

Head annuli two, set off, smaller than those of body (Fig. 165); first one smooth in outer edge and waved, directed laterally, or anteriorly and laterally; second one smaller than the first, smooth on outer edge, waved and collar-like. In face view, labial disk rounded to oval; oral opening I-shaped; six pseudolips arranged in hexagram around oral disk (Figs. 141, 142). Stylet thin and flexible, 99.3-120.5  $\mu\text{m}$  long; knobs robust and anchor shaped, 3.1-6.5  $\mu\text{m}$  high and 8.2-13.0  $\mu\text{m}$  across.

Excretory pore around the level of esophagus end, on 17th-22nd annule and 130.7-207.8  $\mu\text{m}$  from lip. Reproductive system well developed; ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded to oval, with spherical spermatozoa; vagina sigmoid (Fig. 9). Vulva usually on 10th-14th annule from tail end; anterior vulval lip prominent, semicircular, overhanging posterior one, which also semicircular, slightly wider than the first (Fig. 205). Tail conical, with five to eight annuli, 30.9-51.1  $\mu\text{m}$  long, terminus pointed, with shorter scales comparing to those in mid-body (Figs. 224-226).

*Male adult* (Figs. 14, 89, 241-244; Table 26). Body slender, ventrally arched, 440-513  $\mu\text{m}$  (mean = 475  $\mu\text{m}$ , n = 15) long, with 91-125 (111.4) annuli (Figs. 14, 89); head slightly truncated to rounded (Fig. 242); tail elongated conical, terminus pointed. Body annule coarse and angular, 4.2-5.0  $\mu\text{m}$  (4.5) apart, with two transverse striae on each (Fig. 243). Lateral field 4.3-6.0  $\mu\text{m}$  (4.9) wide in mid-body, widened around cloaca, with three inscures. In face view, lip annule oval; oral opening pore like; labial disk arched to dorsal portion; amphid slit like (Fig. 241). Esophagus weakly developed, ended at 32-37 annuli and 106.0-149.7  $\mu\text{m}$  from lip (Fig. 14). Hemizonid two or three annuli long, 32-40 annuli posterior to anterior end; excretory pore on one to four annuli posterior to hemizonid. Testis single, well developed. Cloacal prominence weakly developed, bursa absent. Spicules arched, 43.3-60.0  $\mu\text{m}$  (53.1) long; and gubernaculum simple, rod shaped, 9.3-11.7  $\mu\text{m}$  (10.4) long. Tail elongated conical, 38.0-57.3  $\mu\text{m}$  (51.1) long, with 13-16 annuli (14.5); terminus bluntly pointed,



Figs. 13-18. *Ogma altum* n.sp.: 13. Female adult; 14. Male adult; 15. Fourth-stage juvenile, female; 16. Do., male; 17. Third-stage juvenile; 18. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

with many minute papillae on surface (Fig. 244).

*Fourth-stage juvenile, female* (Figs. 14, 96, 269-272; Table 9). Body cylindrical, almost straight to slightly curved ventrally (Figs. 15, 96); 299-425  $\mu\text{m}$  (mean = 362  $\mu\text{m}$ , n = 10) long, with 60-65 annuli (62.6); bearing ten longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales rectangular, with ogee-shaped appendages on each tip and tiny spine-like projections on each side of a scale (Fig. 271), 14.7-17.9  $\mu\text{m}$  (15.9) long including terminal appendages, and 8.1-10.6  $\mu\text{m}$  (9.2) wide at base.

Head annuli two, set off, directed anteriorly and laterally (Fig. 270); first one 10.7-18.1  $\mu\text{m}$  (15.5) in diameter, with sharply pointed appendages on outer margin; second one 14.0-21.4  $\mu\text{m}$  (17.4) across, larger than and similar in shape to the first. In face view, oral opening I-shaped; oral disk rounded to square, enclosed by narrow ridge, where swelling submedially (Fig. 269). Stylet thin, 75.9-95.7  $\mu\text{m}$  (89.1) long; knobs anchor shaped, occasionally absent (one out of ten juveniles examined). Excretory pore on 20th-23rd annule from lip. Genital primordium elongated, 35.3-98.1  $\mu\text{m}$  (63.4) in length. Tail 30.0-56.1  $\mu\text{m}$  (40.7) long, with seven to ten annuli, conical to elongated conical, terminus bluntly pointed (Fig. 272).

*Fourth-stage juvenile, male* (Figs. 16, 97, 305-308; Table 9). Comparing to the fourth-stage female-juvenile; body more slender; number of scale rows smaller (8-9); stylet shorter; knobs smaller; and genital primordium shorter (33.3-74.2  $\mu\text{m}$ , mean = 49.3, n = 8) and thicker, but other respects corresponding with it.

*Third-stage juvenile* (Figs. 17, 115, 337-340; Table 9). General shape and surface ornate-ments are similar to the fourth-stage female-juvenile; but body smaller; stylet shorter (52.7-73.3  $\mu\text{m}$ ); knobs smaller; genital primordium less developed, oval shaped, 10.0-23.3  $\mu\text{m}$  (mean = 15.4  $\mu\text{m}$ , n = 6) long and 6.0-12.0  $\mu\text{m}$  (8.3) wide.

*Second-stage juvenile* (Figs. 18, 116, 385-388; Table 9). Body cylindrical, small, 170-194  $\mu\text{m}$  (mean = 184  $\mu\text{m}$ , n = 9) long, with 65-70 annuli (Figs. 18, 116). Body scales lobed, semi-circular, ca. 2  $\mu\text{m}$  long and wide, with minute spines on each tip, arranged in alternate rows, 12-18 (14.7) per annule in mid-body (Fig. 357).

Head annuli two (Figs. 358, 359); first one 8.0-9.7  $\mu\text{m}$  (8.8) in diameter, directed posteriorly and laterally, outer margin slightly crenate or smooth, lip region convex; second one crenate, directed posteriorly, larger than the first (9.7-11.0  $\mu\text{m}$ ). Stylet thin, 51.3-58.7  $\mu\text{m}$  (55.9  $\mu\text{m}$ , n = 8) long, with anchor shaped knobs. Genital primordium oval, with two cells, 6.0-10.0  $\mu\text{m}$  (7.5) long and 4.3-6.0  $\mu\text{m}$  (4.6) wide. Tail conical, with eight to ten annuli, terminus bluntly pointed (Fig. 388).

**Type specimens.** Holotype female is deposited in the collection of NIAES. Paratypes: 91 females, 25 males and 100 juveniles. Paratypes of five females will be distributed to the following each institute; USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. Remaining paratypes are retained in NIAES.

**Type locality and habitat.** Holotype and paratype specimens were collected from the rhizosphere of *Thuja Standishii* (GORD.) CARRIERE in Mt. Norikura, Nagano; and from *Pinus koraiensis* SIEB. & ZUCC. in Mt. Yatsugatake (on the Lake Shirakoma-ike), Nagano.

**Diagnosis and relationships.** *O. altum* n.sp. distributes in the sub-alpine zone (above 1,500 m alt.) of the central Honshu. This new species is characterized as follows. Female 431-645  $\mu\text{m}$  in length, with 53-63 annuli. Body scales rectangular to digitate, not arranged in longitudinal rows, but fringed on posterior margins of annules, 38-52 per annule. First head annule smooth, larger than the second; second one smooth on outer edge and waved. In face view, six pseudolips of equal size present. Stylet 99.0-120.5  $\mu\text{m}$  long. Vulva on 10th-14th annule from terminus. Spermatheca with spherical spermatozoa. Body scales of juvenile (fourth stage) elongate trapezoid, with an ogee-arch shaped appendage on each tip and short spines on each sides.

The morphology of the two populations examined are identical in every respects (Table 8) except the numbers of scales per annule (38-52 in Mt. Norikura population and 45-60 in Mt. Yatsugatake one).

*O. altum* n.sp. comes close to *O. proclive* (HOFFMANN, 1973) RASKI & LUC, 1987 by the body scale arrangement and smooth head annule (HOFFMANN, 1973), but can be distinguished from it by lesser numbers of body annuli (67-74 in *O. proclive*), and longer stylet (68.7-80.7  $\mu\text{m}$  in *O. proclive*: HOFFMANN, 1973).

## 6. OGMA VALIDUM N.SP.

**Measurements.** Shown in Table 10 (female adult), Table 11 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 19, 74, 143, 144, 167, 189, 206, 227, 228; Table 10). Body stout, cylindrical (Figs. 19, 74); 453-542  $\mu\text{m}$  long; slightly curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards pointed tail terminus in postvulval part of body. Body annuli coarse, 53-59 in number, each bearing a continuous fringe of scales (Fig. 74). Scales slender spatulate, 1.6-3.3  $\mu\text{m}$  wide and 4.1-7.4  $\mu\text{m}$  long (Fig. 189); 40-60 per annule in mid-body, decreasing in number towards the tail terminus, where scales digitate and their tips directed slightly outwards by SEM observation (Figs. 227, 228).

Head with two annuli, set off (Fig. 167); first one waved, smooth in outer edge, directed anteriorly and laterally; second one distinctly smaller than the first, collar-like, waved and crenate. In face view, oral opening I-shaped; labial disk oval to rounded square; enclosed in dorsal and ventral portions by connected pseudolips, which slightly swelling submedially (Figs. 143, 144). Stylet thin and flexible, 107.2-131.1  $\mu\text{m}$  long; knobs robust and anchor shaped, 4.1-6.6  $\mu\text{m}$  high and 10.7-14.0  $\mu\text{m}$  across.

Excretory pore on 18th-23rd annule and 136.8-168.2  $\mu\text{m}$  from anterior end, or few annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded to oval, with spherical spermatozoa; vagina sigmoid (Fig. 19). Vulva on usually 11th-13th, rarely 15th annule from tail end; anterior vulval lip prominent, rectangular and rounded in each lateral corner of frontal edge, or semicircular, overhanging and almost covering posterior lip; posterior one broad semicircular (Fig. 206). Tail conical,

with six or seven annuli, 38.7-56.1  $\mu\text{m}$  long; terminus not strongly drawn out but bluntly pointed (Figs. 227, 228).

*Male adult* (Figs. 20-22; Table 26). Body slender, ventrally arched, 398-461  $\mu\text{m}$  (mean = 424  $\mu\text{m}$ , n=3) long, with 108-109 (108.7) annuli; head rounded, tail elongated conical and terminus pointed (Figs. 20-22). Body annuli coarse and angulate, 4.1-4.6  $\mu\text{m}$  (4.3) apart; lateral field 4.6  $\mu\text{m}$  wide in mid-body, widened around cloaca, with three inscures. Esophagus weakly developed, ended at 34-49 (36.3) annuli and 99.3-131.2  $\mu\text{m}$  (111.2) from lip. Hemizonid at 36-39 (37.7) annuli posterior to anterior end; excretory pore on usually three to four annuli posterior to hemizonid. Testis single, well developed. Cloacal prominence weakly developed, bursa absent. Tail 24.1-47.0 (37.0)  $\mu\text{m}$  long, with 12-21 (16.0) annuli; terminus pointed, bearing minute papillae on surface (Fig. 22). Spicules arched, 35.9-39.8  $\mu\text{m}$  long; gubernaculum simple, rod-shaped, 8.2-8.5  $\mu\text{m}$  long.

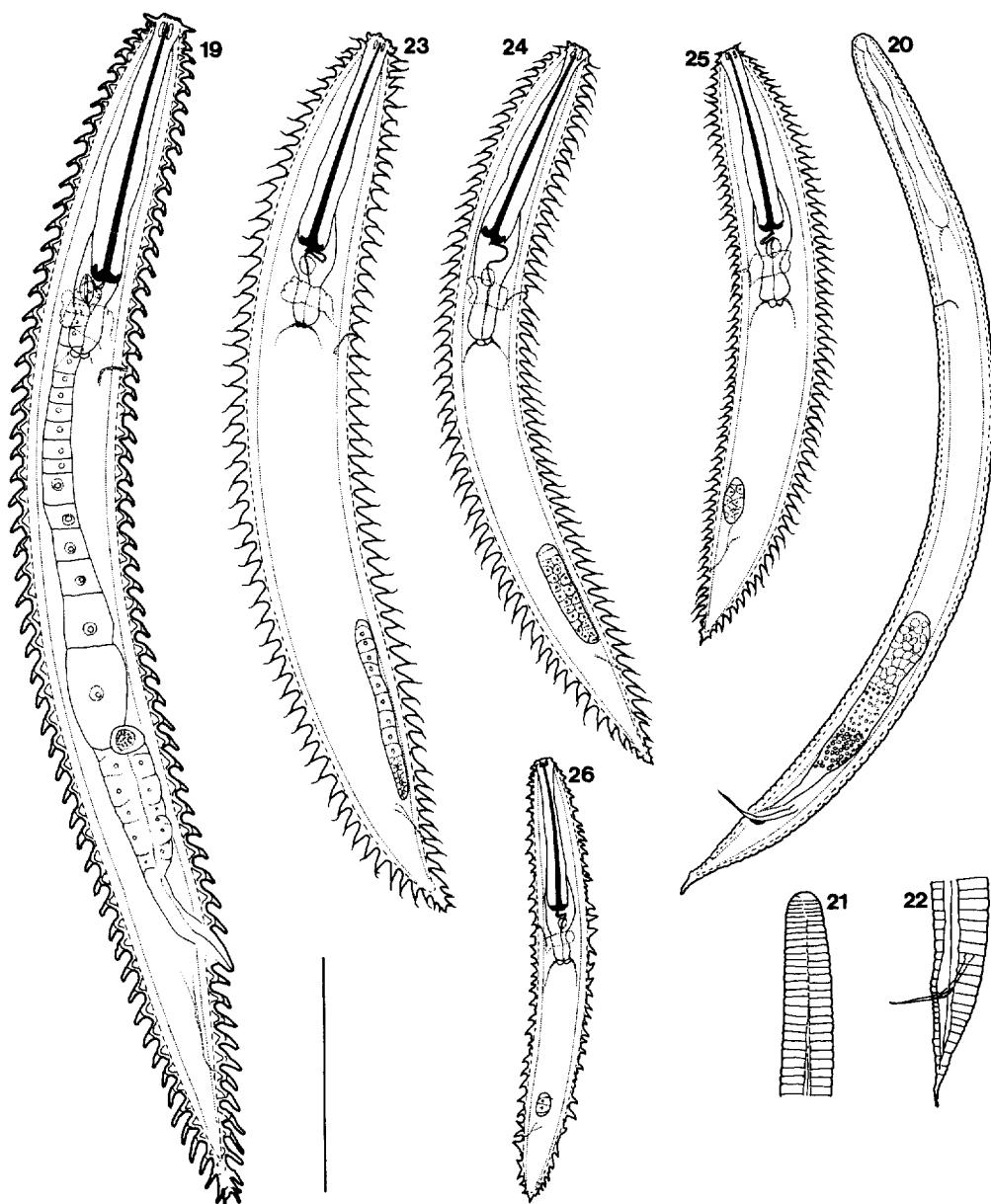
*Fourth-stage juvenile, female* (Figs. 23, 98, 273-276; Table 11). Body stout and cylindrical (Figs. 23, 98); slightly curved ventrally; 245-417  $\mu\text{m}$  (mean = 381  $\mu\text{m}$ , n=10) long, with 56-60 (58.0) annuli; bearing eight to ten (9.1) longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales triangular in shape, with membranous and sharply-pointed triangular-appendages on each tip, 6.5-8.1  $\mu\text{m}$  (7.5) long plus 3.3-4.9  $\mu\text{m}$  (4.3) long appendages, and 7.3-9.8  $\mu\text{m}$  (8.5) wide at base (Fig. 275).

Head annuli two, set off, directed anteriorly and laterally; first one rounded, with slender spines on outer edge, 23-27 in number, 13.0-16.3  $\mu\text{m}$  (14.0) in diameter, with ca. 3  $\mu\text{m}$  long spine-like appendages around it; second one 16.3-21.2  $\mu\text{m}$  (17.8) across, larger than and similar in shape to the first (Fig. 274). In face view, oral disk rounded square; submedian lobes prominent, fused to one each dorsal and ventral portion like a ridge; median lobes not convex, but flattened (Fig. 273). Stylet long and thin, 91.2-99.3  $\mu\text{m}$  (94.9) long; knobs anchor shaped. Excretory pore on 20th-23rd (21.7) annule from lip. Genital primordium elongated, 70.0-123.7  $\mu\text{m}$  (93.8) in length. Tail 34.2-42.3  $\mu\text{m}$  (36.2) long, with eight to ten annuli, bearing slender appendages, terminus pointed (Fig. 276).

*Fourth-stage juvenile, male* (Figs. 24, 99, 309-312; Table 11). Comparing to the fourth-stage female-juvenile, similar in many respects, but some differences are present as follows: body more slender; numbers of scale rows usually smaller (8 in number); stylet shorter (78.1-88.7  $\mu\text{m}$ , mean = 84.3  $\mu\text{m}$ , n=5); knobs smaller; tail longer and slender (Fig. 312); genital primordium shorter (55.3-78.1  $\mu\text{m}$ , mean = 67.7  $\mu\text{m}$ ), thicker and oval shaped.

*Third-stage juvenile* (Figs. 25, 117, 341-344; Table 11). General shape and surface ornatelements are similar to the fourth-stage female-juvenile; but body smaller, 193-259  $\mu\text{m}$  (mean = 232  $\mu\text{m}$ , n=6) long; stylet shorter; knobs smaller; genital primordium less developed, oval shaped, 14.7-29.3  $\mu\text{m}$  (19.9) long and 6.5-11.4  $\mu\text{m}$  (8.7) wide.

*Second-stage juvenile* (Figs. 26, 118, 389-392; Table 11). Body cylindrical, small, 186-192  $\mu\text{m}$  (mean = 189  $\mu\text{m}$ , n=3), with 62-65 (63.7) annuli (Figs. 26, 118). Body scales lobed, semicircular in shape, 2.9-3.3  $\mu\text{m}$  (3.2) long and 3.0-4.6  $\mu\text{m}$  (4.1) wide at base, with minute spines on each tip, arranged in alternate rows, seven to nine (8.3) per annule in mid-body (Fig. 391).



Figs. 19-26. *Ogma validum* n.sp.: 19. Female adult; 20. Male adult, general view; 21. Do., anterior body; 22. Do., posterior body; 23. Fourth-stage juvenile, female; 24. Do., male; 25. Third-stage juvenile; 26. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

Head annuli two (Figs. 389, 390); first one set off, 9. 1-12. 4  $\mu\text{m}$  (10. 4) in diameter, directed laterally, outer margin slightly crenate, lip region convex; second one strongly directed posteriorly, posterior margin distinctly crenate, larger than the first (11. 1-13. 7  $\mu\text{m}$  (12. 2)). Stylet slender, 60. 3-67. 2  $\mu\text{m}$  (64. 5) long, with anchor shaped knobs. Genital primordium oval, with two cells, 8. 5-9. 8  $\mu\text{m}$  (9. 1) long and 5. 2-7. 8  $\mu\text{m}$  (6. 9) wide. Tail conical, with nine annuli, terminus pointed (Fig. 392).

**Type specimens.** Holotype female is deposited in NIAES. Paratypes: 40 females, 3 males and 68 juveniles. Paratypes of two females will be distributed to the following each institute; USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. The remaining paratypes are retained in NIAES.

**Type locality and habitat.** Holotype and paratypes were obtained from the rhizosphere of *Distylium racemosum* SIEB. & ZUCC., *Rhododendron Tashiroi* MAXIM., *Syzygium buxifolium* HOOK. & ARNOTT, *Eurya japonica* THUNB. and *Camellia japonica hozanensis* (HAYATA) KITAMURA in the University Forest of the Ryukyu University, Kunigami, Okinawa.

**Diagnosis and relationships.** *O. validum* n.sp. distributes in Okinawa Is. This new species is characterized as follows. Female 453-542  $\mu\text{m}$  in length, with 53-59 annuli. Body scales elongated spatulate to digitate, fringed, 40-60 per annule in mid-body. First head annule smooth, larger than the second, second one crenate. In face view, oral disk rimed by prominent median lips, submedian lobes slightly developed. Stylet 107. 2-131. 1  $\mu\text{m}$  long. Vulva on 11th-15th annule from terminus. Spermatheca with spherical spermatozoa. Tail conical, with six or seven annuli, terminus pointed. Body scales of juvenile (fourth stage) rectangular, with a leaf shaped appendages on each tip.

*O. validum* n.sp. resembles *O. fimbriatum* (COBB in TAYLOR, 1936) SIDDIQI, 1986 by the numbers of body annuli and scales per annule, shape of body scales, and stylet length, but this can be distinguished from it in the smooth head annule (crenate in *O. fimbriatum*), shape of lips at face (six well developed lips in *O. fimbriatum*; TAYLOR, 1936; MEHTA & RASKI, 1971) and lobed scale-appendages of juvenile stage (spiny in *O. fimbriatum*; EBSARY, 1979).

## 7. OGMA DRYUM (MINAGAWA, 1979) RASKI & LUC, 1987

**References.** MINAGAWA, 1979, p. 25-27, fig. 1 A-H (*Crossonema*); TOIDA, 1983, p. 18 (*Crossonema*); SIDDIQI, 1986, p. 379 (*Crossonema (Neocrossonema)*); RASKI & LUC, 1988, p. 414 (*Ogma*); EBSARY, 1991, p. 66 (*Ogma*).

**Measurements.** Shown in Table 12 (female adult), Table 13 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 27, 75-78, 145-147, 168, 190-192, 207, 229-231; Table 12). Body stout, cylindrical to spindle shaped (Figs. 27, 75-78); 340-519  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards sharply pointed tail terminus in postvulval part of body. Body annuli coarse, 48-59 in number, each bearing a fringe of scales (Figs. 190-192). Scales digitate to elongate triangular, 4. 1-6. 6  $\mu\text{m}$  long, rarely smaller (Figs. 190-192); 20-44 per annule in mid-body, decreasing in number and size towards tail terminus (Figs. 229-231).

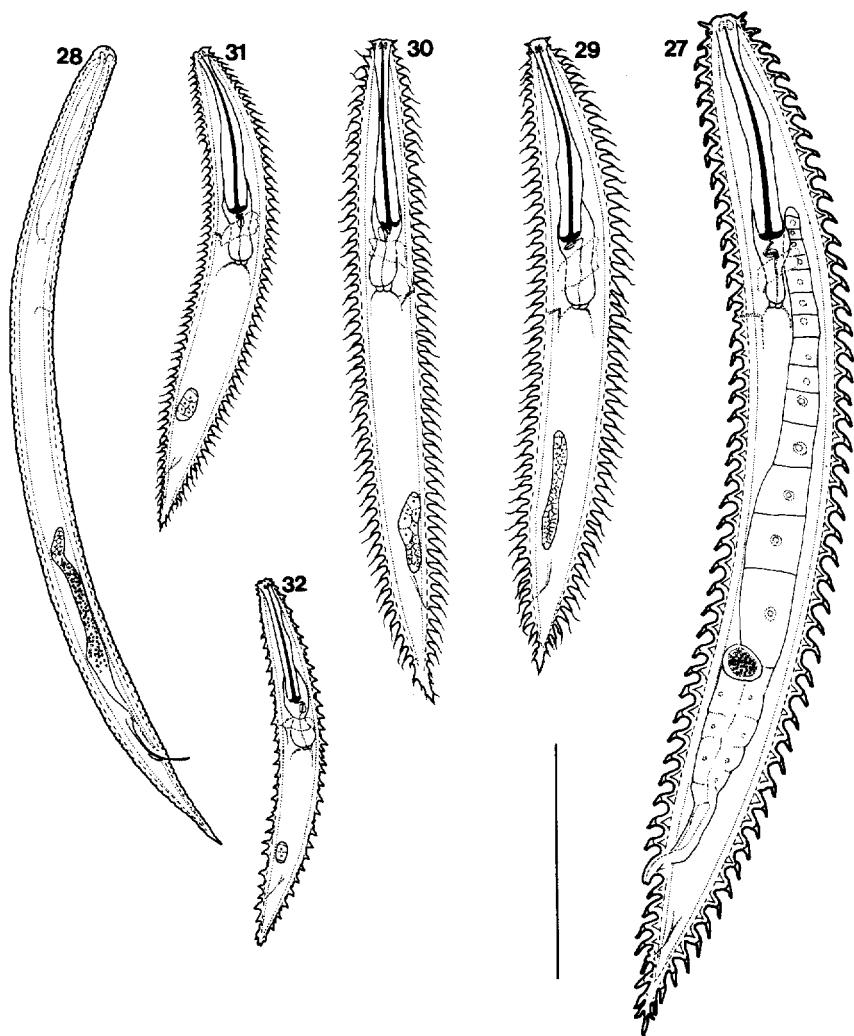
Head annuli two, set off (Fig. 168); first one saucer shaped, waved, crenate in outer margin, directed laterally and anteriorly; second one crenate or smooth, distinctly smaller than the first. In face view, oral disk oval; oral opening I-shaped; six pseudolips arranged in hexagram around oral disk, lateral portions larger than others, submedian lobes occasionally developed (Figs. 145-147). Stylet thin and flexible, 89. 1-117. 1  $\mu\text{m}$  long; knobs anchor shaped, 2. 4-3. 3  $\mu\text{m}$  high and 6. 2-9. 9  $\mu\text{m}$  across.

Excretory pore on 17th-27th annule and 107. 2-174. 8  $\mu\text{m}$  from anterior end, few annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded to oval, filled with spherical spermatozoa; vagina sigmoid (Fig. 27). Vulva on 10th-12th annule from tail end; anterior vulval lip prominent, semicircular, overhanging and covering posterior lip, which broad semicircular (Fig. 207). Tail conical, with five to seven annuli, 17. 9-52. 8  $\mu\text{m}$  long; terminus usually strongly drawn out and pointed (Figs. 229-231).

*Male adult* (Figs. 28, 90, 245-248; Table 26). Body slender, ventrally arched, 337-391  $\mu\text{m}$  (mean = 365  $\mu\text{m}$ , n = 25) long, with 104-124 (109) annuli (Figs. 28, 90); head slightly truncated to rounded (Fig. 246); tail elongated conical, terminus pointed. Body annuli coarse and angular, 3. 2-4. 0  $\mu\text{m}$  (3. 6) apart; lateral field 3. 0-4. 3  $\mu\text{m}$  (3. 6) wide in mid-body, widened around cloaca, with three inscures (Fig. 247). In face view, oral opening triangular pore, amphid slit like, labial disk oval to square (Fig. 245). Esophagus weakly developed, ended at 29th-39th annule (32. 9) and 94. 0-110. 0  $\mu\text{m}$  from lip. Excretory pore at 33th-44th annule (39. 1) from anterior terminus. Hemizonid two annuli long, at 32-40 annuli (36. 8) posterior to anterior end; and naught to four annuli posterior to hemizonid. Testis single, well developed. Cloacal prominence not developed, bursa absent. Tail elongated conical, curved ventrally, 40. 0-53. 3  $\mu\text{m}$  long, with 12-18 annuli, terminus slender with minute papillae on surface (Fig. 248). Spicules arched, 34. 3-42. 7  $\mu\text{m}$  long; and gubernaculum simple, rod shaped, 6. 7-7. 3  $\mu\text{m}$  long.

*Fourth-stage juvenile, female* (Figs. 29, 100, 277-280; Table 13). Body stout and spindle shaped (Figs. 29, 100); slightly curved ventrally; 235-280  $\mu\text{m}$  (mean = 260  $\mu\text{m}$ , n = 10) long, with 54-64 annuli (58. 0); bearing eight to 11 (9. 6) longitudinal rows of scales around mid-body, decreasing in number in both ends. Body scales semicircular in shape, bearing membranous, foliate appendage on each tip, which hardly visible from front by a optical microscope, 5. 9-7. 8  $\mu\text{m}$  (6. 9) long scale plus 4. 6-5. 9  $\mu\text{m}$  (5. 4) long appendage and 4. 9-7. 8  $\mu\text{m}$  (6. 9) wide at base (Fig. 279).

Head annuli two, set off; first annule directed anteriorly and laterally, crenate, with short, rounded projections or pointed spines bearing minute needle shaped appendage on each tip, 22-25 (22. 5) teeth on outer edge in irregular intervals, 10. 7-15. 3  $\mu\text{m}$  (12. 3) in diameter; second one directed laterally, slightly larger than the first, 11. 3-14. 0  $\mu\text{m}$  (12. 7) across, crenate, with smaller teeth comparing those of the first (Fig. 278). In face view, oral opening I-shaped; labial disk rounded square, rimed by narrow ridge; submedian lobes rounded and prominent, lateral lips not convex, broad and semicircular (Fig. 277). Stylet



Figs. 27-32. *Ogma dryum* (MINAGAWA, 1979): 27. Female adult; 28. Male adult; 29. Fourth-stage juvenile, female;  
30. Do., male; 31. Third-stage juvenile; 32. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

thin, 80.0-92.4  $\mu\text{m}$  (84.9) long; knobs anchor shaped. Excretory pore on 21st-26th annule from lip. Genital primordium elongated, 46.7-68.4  $\mu\text{m}$  (54.9) in length. Tail 21.3-42.7  $\mu\text{m}$  (29.5) long, with seven to ten annuli, bearing slender appendages, terminus pointed (Fig. 280).

*Fourth-stage juvenile, male* (Figs. 30, 101, 313-316; Table 13). Similar to the fourth-stage female-juvenile in most respects, but some differences present as follows: body more slender; usually smaller in numbers of scale rows (7-9 rows (mean=8.0, n=3)); stylet shorter; knobs smaller; first head annule smaller than the second (8.2-11.5  $\mu\text{m}$  (10.4) vs. 10.7-18.1  $\mu\text{m}$  (13.4)), more roughly crenate, with shorter 16-20 teeth (mean=18, n=2) on outer edge (Fig. 313); genital primordium shorter, 19.9-33.8  $\mu\text{m}$  (27.2) long and elongated oval; tail longer (31.3-42.9  $\mu\text{m}$  (36.3)) and more slender (Fig. 316).

*Third-stage juvenile* (Figs. 312, 119, 345-348; Table 13). General shape and surface ornate are similar to the fourth-stage female-juvenile; but body smaller, 172-210  $\mu\text{m}$  (mean=187  $\mu\text{m}$ , n=10) long, with equal or slightly larger number of annuli; stylet shorter and knobs smaller; first head annule with ca. 20 triangular teeth on outer edge (Fig. 293); genital primordium less developed, oval shaped, 7.3-15.3  $\mu\text{m}$  (11.2) long and 4.3-7.0  $\mu\text{m}$  (5.6) wide.

*Second-stage juvenile* (Figs. 32, 120, 393-396; Table 13). Body cylindrical to spindle shaped, small, 134-171  $\mu\text{m}$  (mean=149  $\mu\text{m}$ , n=10), with 63-67 annuli (64.5) (Figs. 32, 120). Body scales lobed, triangular in shape, ca. 2  $\mu\text{m}$  long and ca. 1.5  $\mu\text{m}$  wide at base, with four to six very minute spines (0.2-0.3  $\mu\text{m}$  long) on each tip by SEM observation, arranged in alternate rows, seven or eight, rarely ten (7.8) per annule in mid-body (Fig. 395).

Head annuli two, set off (Figs. 393, 394); first one 7.3-8.7  $\mu\text{m}$  (7.8) diameter, directed laterally, outer margin slightly crenate, lip region convex; second one crenate, directed posteriorly, larger than the first, 8.0-9.3  $\mu\text{m}$  (8.6) in diameter. Stylet thin, 46.7-53.3  $\mu\text{m}$  (50.2) long, with anchor shaped knobs. Genital primordium oval, with two cells, 6.7-9.0  $\mu\text{m}$  (7.8) long and 4.3-5.7  $\mu\text{m}$  (4.9) wide. Tail conical, with five to nine annuli, 11.3-22.0  $\mu\text{m}$  (18.7) long, terminus pointed (Fig. 396).

**Specimens examined.** *O. dryum* is distributing in Kyushu, Shikoku, Honshu and Hokkaido. This species were obtained from rhizosphere of the following plants and localities; *Elaeagnus pungens* THUNB., *Quercus acutissima* CARRUTHERS, *Q. serrata* MURRAY and *Q. acuta* THUNB. in Nishigoshi (Type locality), Kumamoto; *Pieris japonica* (THUNB.) D. DON, *Hirwingia japonica* (THUNB.) F. G. DIETR., *Euonymus Sieboldianus* BLUME, *Elaeagnus pungens*, *Acer* sp., *Prunus* (*Cerasus*) sp., *Sorbus japonica* (DECNE.) HELDLUND, *Rubus palmatus* THUNB., *Hydrangea luteovenosa* KOIDZUMI, *H. paniculata* SIEB., *Lindera triloba* (SIEB. & ZUCC.) BLUME in Mt. Aso, Kumamoto; *Quercus* sp. in Takamatsu, Kagawa; *Torreya nucifera* SIEB. & ZUCC. and *Prunus* (*Cerasus*) sp. in Misugi, Mie; *Quercus mongolica* var. *grosseserrata* (BL.) REHDER & WILSON and *Betula platyphylla* var. *japonica* (MIQ.) HARA in Mt. Norikura, Nagano; *Betula platyphylla* var. *japonica* in Nakakaruiwaza, Nagano; *Quercus acutissima*, *Q. dentata* THUNB., *Q. serrata* and *Corylus heterophylla* FISCHER in Tsukuba, Ibaraki; *Larix Kaempferi* (LAMB.) CARRIERE, *Prunus* (*Cerasus*) sp. and *Betula platyphylla* var. *japonica* in Kusatsu, Gunma; *Styrax japonica* SIEB. &

ZUCC., *Wisteria floribunda* (WILD.) DC, *Stephanandra incisa* (THUNB.) ZABEL, *Hamamelis japonica* SIEB. & ZUCC., *Castanea crenata* SIEB. & ZUCC. and *Carpinus laxiflora* (SIEB. & ZUCC.) BLUME in Nishinasuno, Tochigi; *Quercus mongolica* var. *grosseserrata* in Nopporo, Hokkaido.

**Remarks.** *O. dryum* widely distributes in Japan from north (Hokkaido) to south (Kyushu), and from near the sea level to subalpine zone.

*O. dryum* is characterized as follows. Female 340-519  $\mu\text{m}$  in length, with 48-57 annuli. Body scales elongated triangular, arranged in continuous rows, 20-44 per annule in mid-body. First head annule crenate, larger than the second, which crenate or smooth. In face view, six well-developed lips present, submedian lobes slightly developed. Stylet 89. 1-117. 1  $\mu\text{m}$  long. Vulva on 9th-13th annule from terminus. Spermatheca with spherical spermatozoa. Tail elongated conoid, with usually five to seven, rarely eight or nine annuli, terminus drawn out and pointed. Body scales of juvenile (fourth stage) rectangular, with a broad lief-shaped appendage on each tip. Although this species widely distributes in Japan, there are no notable intraspecific variations among populations (Table 12).

This species resembles *O. fimbriatum*, but it can be separated from it by the smaller numbers of body scales per annule (40-52 in *O. fimbriatum*; TAYLOR, 1936; MEHTA & RASKI, 1971; MINAGAWA, 1979), and scale appendages of juvenile stage (spiny in *O. fimbriatum*: EBSARY, 1979).

## 8. OGMA YAMBARUENSE N.SP.

**Measurements.** Shown in Table 14 (female adult), Table 15 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 33, 79, 148, 169, 193, 208, 232; Table 14). Body stout, cylindrical to spindle shaped (Figs. 33, 79); 371-464  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards pointed tail terminus in postvulval part of body. Body annuli coarse, 54-59 in number, each bearing a continuous fringe of scales. Scales elongated conoid and/or digitate, 1. 6-3. 3  $\mu\text{m}$  wide and 4. 9-9. 8  $\mu\text{m}$  long; 30-38 per annule in mid-body (Fig. 193), decreasing in number towards the tail terminus (Fig. 232).

Head annuli two, set off (Fig. 169); first one saucer like, waved, smooth and some shallow notches in outer edge, directed laterally and anteriorly; second one distinctly smaller than the first. In face view, oral opening I-shaped; labial disk oval; labial lips rounded, six in number, equal in size and shape, enclosing oral disk (Fig. 148). Stylet thin and flexible, 102. 6-123. 7  $\mu\text{m}$  long; knobs anchor shaped, 2. 4-3. 3  $\mu\text{m}$  high and 7. 3-9. 0  $\mu\text{m}$  across.

Excretory pore on 20th-22nd annule, 130. 2-155. 1  $\mu\text{m}$  from anterior end, around the same level of or few annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, occasionally with one or two flexures near terminus; spermatheca rounded to oval, with spherical spermatozoa; vagina sigmoid (Fig. 33). Vulva on 11th or 12th annule from tail end; anterior vulval lip prominent, rectangular to semicircular, overhanging and covering posterior one, which broad semicircular (Fig. 208). Tail conical, with usually five or six, rarely four or seven annuli, 19. 5-39. 6 (30. 8 $\pm$ 5. 1)  $\mu\text{m}$  long, ter-

minus drawn out and pointed (Fig. 232).

*Male adult* (Figs. 34, 36; Table 26). Body slender, ventrally arched, 280–329  $\mu\text{m}$  (mean = 305  $\mu\text{m}$ , n = 2) long, with 108–112 (110.0) annuli (Fig. 34); head slightly truncated to rounded (Fig. 35), tail elongated conical, terminus pointed. Body annuli coarse and angular, 2.7–3.1  $\mu\text{m}$  (2.9) apart; lateral field 3.3  $\mu\text{m}$  wide in mid-body, slightly widened around cloaca, with three inscures, which originated from near lip. Esophagus weakly developed, ended at 32 or 33 annuli, 71.7–73.0  $\mu\text{m}$  from lip. Excretory pore on 38th–44th annule from anterior terminus. Hemizonid two annuli long, at 36–43 annuli posterior to anterior end, one or two annuli posterior to excretory pore. Testis single, well developed. Cloacal prominence not developed, bursa absent. Tail elongated conical, curved ventrally, 34.6–37.8  $\mu\text{m}$  (36.2) long, with 13–14 annuli, terminal surface with small papillae (Fig. 36). Spicules arched, 31.3–39.8  $\mu\text{m}$  long; and gubernaculum simple, rod shaped, 7.2–7.8  $\mu\text{m}$  long.

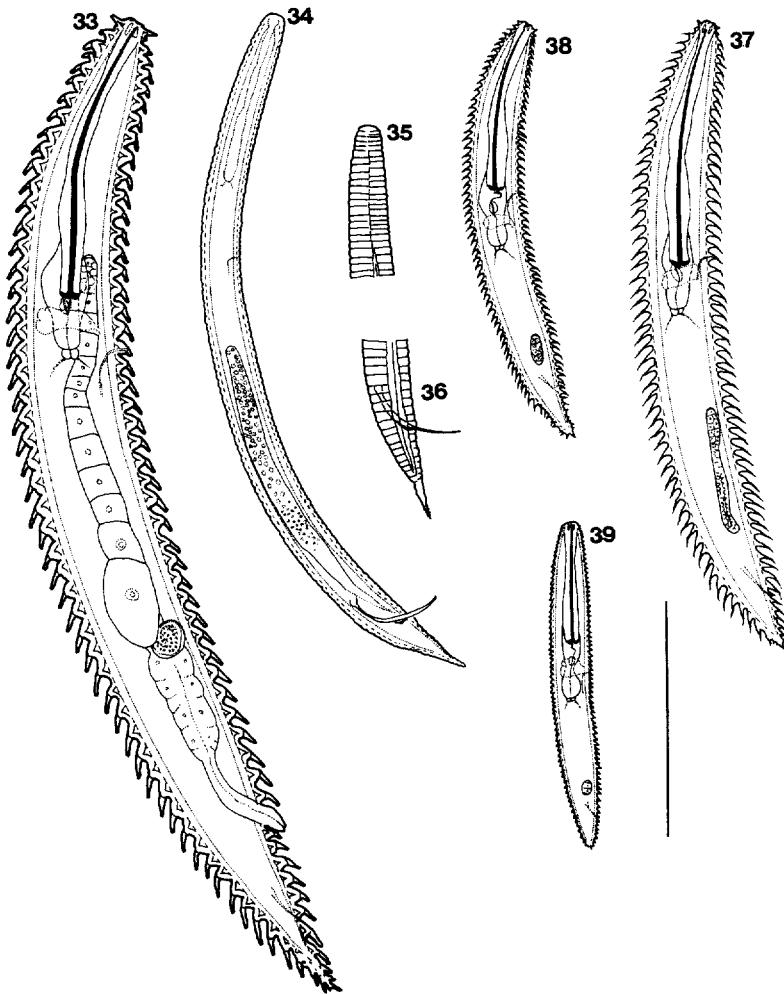
*Fourth-stage juvenile* (Figs. 37, 102, 281–284; Table 15). Body stout, and spindle to cylindrical shaped (Figs. 37, 102); slightly curved ventrally; 252–316  $\mu\text{m}$  (mean = 278  $\mu\text{m}$ , n = 10) long, with 58–64 annuli (60.9); bearing eight or nine (8.4) longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales semicircular in shape, bearing an elongated triangular and sharply pointed appendage on each tip, occasionally additional minute ones both sides of the terminal appendage, which hardly visible by a optical microscope, 6.5–9.8  $\mu\text{m}$  (7.9) long scale plus 2–4  $\mu\text{m}$  long appendages, and 6.5–9.8  $\mu\text{m}$  (7.8) wide at base (Fig. 283).

Head annuli two, set off (Fig. 282); first annule directed anteriorly and laterally, crenate with rounded teeth of irregular intervals, ca. 25 in number, 10.6–12.2  $\mu\text{m}$  (11.3) in diameter; second one directed laterally, larger than the first, 11.4–13.0  $\mu\text{m}$  (12.6) across, distinctly crenate. In face view, oral opening I-shaped; labial disk rounded square; submedian lobes developed and lateral lips rounded (Fig. 281). Stylet thin, 91.2–100.9  $\mu\text{m}$  (96.3) long; knobs anchor shaped or flat in anterior surface. Excretory pore on 22nd–26th annule from lip. Genital primordium 52.1–78.1  $\mu\text{m}$  (61.9) long. Tail conical, 22.0–30.9  $\mu\text{m}$  (25.0) long, with seven or eight annuli (7.2), bearing short and slender appendages, terminus pointed (Fig. 284).

*Third-stage juvenile* (Figs. 38, 121, 349–352; Table 15). General shape and surface ornamentalations are similar to the fourth-stage female-juvenile; but body smaller, 188–230  $\mu\text{m}$  (mean = 195  $\mu\text{m}$ , n = 7) long; stylet shorter; knobs smaller; first head annule not distinctly but slightly crenate on outer edge (Figs. 349, 350); genital primordium less developed, oval shaped, 8.1–22.8  $\mu\text{m}$  (15.0) long and 5.7–8.1  $\mu\text{m}$  (6.8) wide; tail longer comparing to the body length.

*Second-stage juvenile* (Figs. 39, 122, 397–400; Table 15). Body small and cylindrical, 136–155  $\mu\text{m}$  (mean = 144  $\mu\text{m}$ , n = 4) long, with 62–68 (64.5) annuli (Figs. 39, 122). Body scales lobed, small triangular, 1.3–2.9  $\mu\text{m}$  (1.9) long and 2.3–2.6  $\mu\text{m}$  (2.5) wide, with usually one or two, occasionally more spines on each tip, arranged in partly alternate rows but mostly scatter, 18–22 per annule in mid-body (Fig. 399).

Head annuli two, set off (Fig. 398); first one 7.2–7.5  $\mu\text{m}$  (7.6) in diameter, directed post-



Figs. 33-39. *Ogma yambaruense* n.sp.: 33. Female adult; 34. Male adult, general view; 35. Do., anterior body; 36. Do., posterior body; 37. Fourth-stage juvenile, female; 38. Third-stage juvenile; 40. Second-stage juvenile.  
Scale bar indicates 50  $\mu\text{m}$ .

eriorly and laterally, outer margin crenate, lip region convex; second one crenate, directed posteriorly, 8. 5  $\mu\text{m}$  in diameter, larger than the first (Figs. 397, 398). Stylet slender, 48. 5-50. 9  $\mu\text{m}$  (49. 4, n=3) long, with anchor shaped knobs, knobs and shaft occasionally absent (one out of four juveniles examined). Genital primordium oval, with tow cells, 7. 2-7. 8  $\mu\text{m}$  (7. 5) long and 4. 6-5. 2  $\mu\text{m}$  (5. 0) wide. Tail conical, with eight to ten annuli, 14. 3-19. 6  $\mu\text{m}$  (16. 8) long, terminus bluntly pointed (Fig. 400).

**Type specimens.** Holotype female is deposited in NIAES. Paratypes: 42 females, two males and 21 juveniles. Paratypes of two females will be distributed to the following each institute; USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. Remaining paratypes are on deposit in NIAES.

**Type locality and habitat.** Type specimens were obtained from the rhizosphere of *Ilex liukiuensis* LOESEN, *Symplocos microcalyx* HAYATA and *Acacia confusa* MERRILL in the University Forest of the Ryukyu University, Kunigami, Okinawa.

**Diagnosis and relationships.** *O. yambaruense* n.sp. distributes in Okinawa Is. This new species is characterized as follows. Female 371-464  $\mu\text{m}$  in length, with 54-59 annuli. Body scales digitate, fringed, 30-38 per annule in mid-body. First head annule larger than the second, smooth, sometimes with slight notch on outer edge; second one smooth and collar-like. In face view, six pseudolips present. Stylet 102. 6-123. 7  $\mu\text{m}$  long. Vulva on 11th or 12th annule from terminus. Spermatheca with spherical spermatozoa. Tail conical to elongated conical, with four to seven annuli, terminus drawn out. Body scales of juvenile (fourth stage) semicircular to rectangular, with an elongated triangular appendage on each tip.

*O. yambaruense* n.sp. most resembles *O. dryum* by the shape and arrangement of body scales, but can be distinguished from it by the almost smooth head annule (crenate in *O. dryum*), more slender body scales (elongated triangular in *O. dryum*) and lip structure (MINAGAWA, 1979; this issue).

## 9. OGMA ABIES (ANDRÁSSY, 1979) RASKI & LUC, 1987

**References.** ANDRÁSSY, 1979, p. 52-54, fig. 15 A-C (*Crossonema*); EBSARY, 1981, p. 104 (*Neocrossonema*); SIDDIQI, 1986, p. 379 (*Crossonema (Neocrossonema)*); RASKI & LUC, 1988, p. 413 (*Ogma*); EBSARY, 1991, p. 65 (*Ogma*).

**Synonyms.** *Crossonema capitospinosum* EBSARY, 1979 (*N.Syn.*): EBSARY, 1979, p. 2319, fig. 1 A-H (*Crossonema*); EBSARY, 1981, p. 104 (*Neocrossonema*); SIDDIQI, 1986, p. 379, fig. 95 A-B (*Crossonema (Neocrossonema)*); RASKI & LUC, 1987, p. 414 (*Ogma*); LOOF, 1988, p. 143, fig. 3 A-B (*Ogma*); EBSARY, 1991, p. 65 (*Ogma*).

*Crossonema villifera* EROSHENKO, 1980 (*N.Syn.*): EROSHENKO, 1980, p. 103-104, fig. 1 (*Crossonema*); SIDDIQI, 1986, p. 381 (*Crossonema (Neocrossonema)*); RASKI & LUC, 1987, p. 416 (*Ogma*); EBSARY, 1991, p. 69 (*Ogma*).

**Measurements.** Shown in Table 16 (female adult), Table 17 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 40, 80, 149, 150, 170, 171, 194, 195, 209, 233; Table

16). Body stout, cylindrical to spindle shaped (Figs. 40, 80); 366-517  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards the pointed tail terminus in postvulval part of body. Body annuli course, 63-69 in number, each bearing a continuous fringe of scales (Fig. 80). Scales fir-leaf shaped, 1.6-2.4  $\mu\text{m}$  wide and 5.7-9.0  $\mu\text{m}$  long (Figs. 194, 195); 44-60 per annule in mid-body, decreasing in number towards the both sides of body and their tips curved outwards by SEM observation (Fig. 233).

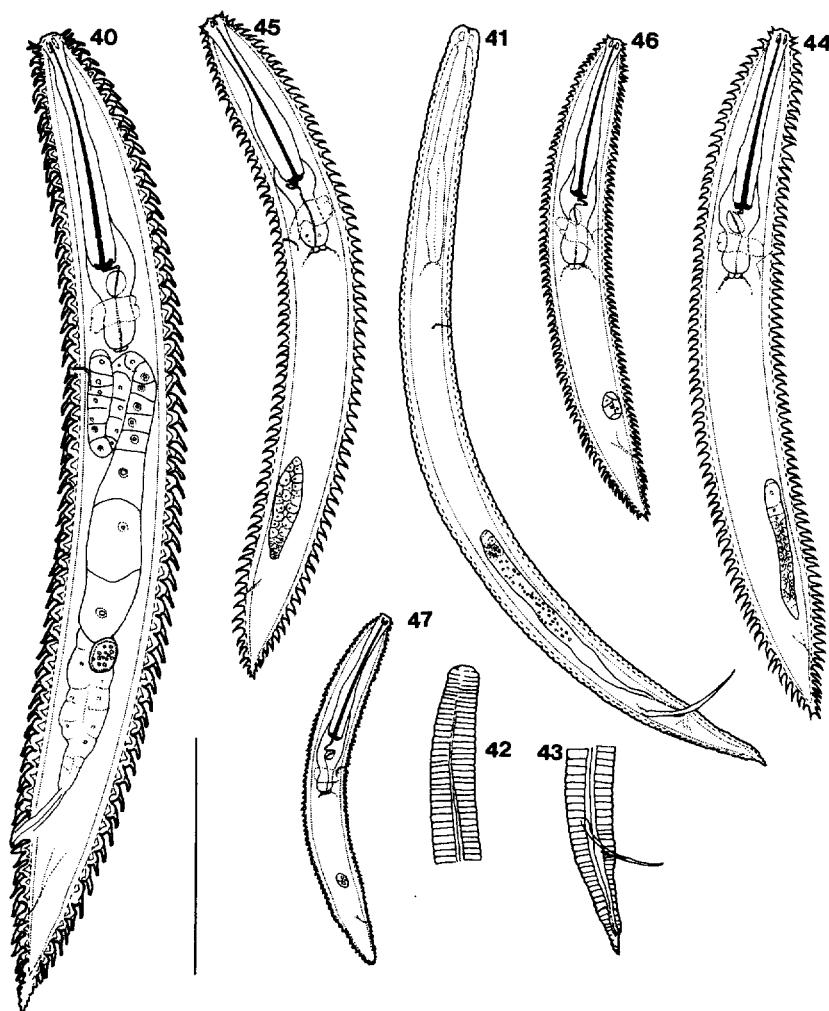
Head annuli two, set off (Figs. 170, 171); first one spined (2-3  $\mu\text{m}$  long, simple or occasionally bifurcate, 36-40 in number) in outer edge, directed anteriorly and laterally; second one equal to or slightly larger than the first, also spined, directed laterally, or laterally and posteriorly like those of body annuli. In face view, oral opening I-shaped; pseudolips six, arranged in hexagram around oral disk (Figs. 149, 150). Stylet thin and flexible, 92.4-103.1  $\mu\text{m}$  long; knobs anchor shaped, 2.4-4.1  $\mu\text{m}$  high and 8.2-9.9  $\mu\text{m}$  across.

Excretory pore on 22nd-26th annule and 117.1-179.8  $\mu\text{m}$  from anterior end, or around the same level of or a few annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, terminus reaching to esophagus end, occasionally with one or two flexures near terminus; Spermatheca rounded to oval, developed, filled with spherical spermatozoa; vagina sigmoid (Fig. 80). Vulva usually on 13th-15th, rarely 16th or 17th annule from tail end; anterior vulval lip prominent, semicircular, or rectangular with rounded frontal margin, overhanging posterior one, which broad semicircular (Fig. 209). Tail conical, with seven to nine annuli, 29.7-42.9  $\mu\text{m}$  long, terminus pointed (fig. 233).

*Male adult* (Figs. 41-43, 91, 249-252; Table 26). Body slender and cylindrical, 313-396  $\mu\text{m}$  (mean = 371  $\mu\text{m}$ , n = 9) long, with 125-132 (129.8) annuli (Fig. 41); head slightly truncated (Fig. 250); tail elongated conical, terminus pointed. Body annuli angular, 2.7-3.3  $\mu\text{m}$  (2.8) apart; lateral field 3.7-5.0  $\mu\text{m}$  (4.6) wide in mid-body, widened around cloaca, with three inscures (Fig. 251). In face view, lip annule oval, oral opening rounded, surrounding with narrow rim, amphid semicircular (Fig. 249). Esophagus weakly developed, terminated at 32nd-36th annule and 80.0-96.7  $\mu\text{m}$  from lip. Hemizonid at 34-41 annuli posterior to anterior end; excretory pore at 40th-49th annule or 104.0-31.3  $\mu\text{m}$  (118.5) from lip, four to eight annuli posterior to hemizonid. Cloacal prominence not developed, bursa absent. Tail elongated conical, 26.7-49.3  $\mu\text{m}$  (40.6) long, with 16-19 annuli (17.6), terminus pointed and bearing minute papillae on surface (Figs. 43, 252). Spicules arched, 42.0-48.0  $\mu\text{m}$  long; gubernaculum simple, rod-shaped, 7.3-8.7  $\mu\text{m}$  long.

*Fourth-stage juvenile, female* (Figs. 44, 103, 285-288; Table 17). Body stout and spindle to cylindrical shaped (Figs. 44, 103); slightly curved ventrally after gentle heat treatment; 262-351  $\mu\text{m}$  (mean = 286  $\mu\text{m}$ , n = 10) long, with 63-73 annuli (69.3); bearing 10-12 (10.9) longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales semicircular in shape, 6.5-8.1  $\mu\text{m}$  (7.2) long and 6.2-10.3  $\mu\text{m}$  (6.9) wide at base, bearing an elongated triangular, sharply pointed spine-like appendages on each tip, two to six in number (Fig. 287).

Head annuli two, set off; first annule directed anteriorly and laterally, 10.6-12.2  $\mu\text{m}$



Figs. 40-47. *Ogma abies* (ANDRÁSSY, 1979): 40. Female adult; 41. Male adult, general view; 42. Do., anterior body; 43. Do., posterior body; 44. Fourth-stage juvenile, female; 45. Do., male; 46. Third-stage juvenile; 47. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

(11. 3) in diameter, crenate, with rounded teeth, 13-17 in number, bearing sharply pointed appendages on tips; second one spined, directed laterally, larger than the first, 11. 4-14. 0  $\mu\text{m}$  (13. 0) across (Fig. 286). In face view, oral opening I-shaped; labial disk rounded square; submedian lobes small, but rounded and prominent; lateral lips rounded but not prominent (Fig. 285). Stylet thin, 73. 3-93. 0  $\mu\text{m}$  (81. 1) long; knobs anchor shaped. Excretory pore on 24th-27th annule from lip. Genital primordium 48. 8-104. 2  $\mu\text{m}$  (67. 4) long. Tail conical, 21. 1-30. 9  $\mu\text{m}$  (27. 2) long, with eight to ten annuli (8. 8), bearing membranous appendages, terminus bluntly pointed (Fig. 288).

*Fourth-stage juvenile, male* (Fig. 45, 317-320; Table 17). One male juvenile is available to measure and another for examination by SEM. Comparing to the fourth-stage female-juvenile, body more slender, with ten longitudinal rows of scales in mid-body; style shorter; knobs smaller; and genital primordium shorter (53. 7  $\mu\text{m}$ ) and thicker, but other respects corresponding with it.

*Third-stage juvenile* (Figs. 45, 123, 353-356; Table 17). General shape and surface ornate-ments are similar to the fourth-stage female-juvenile; but body smaller, 189-234  $\mu\text{m}$  (mean = 213  $\mu\text{m}$ , n = 10) long, with larger numbers of annuli (70-76); stylet shorter; knobs smaller; first head annule spined on outer edge but less developed (Figs. 353, 354); genital primordium less developed, oval shaped, 13. 0-17. 9  $\mu\text{m}$  (15. 5) long and 6. 5-9. 8 (8. 5) wide.

*Second-stage juvenile* (Figs. 46, 124, 401-404; Table 17). Body small and cylindrical, 132-162  $\mu\text{m}$  (mean = 146  $\mu\text{m}$ , n = 10) long, with 73-78 (75. 3) annuli (Figs. 46, 124). Body scales small, semicircular, 1. 3-1. 7  $\mu\text{m}$  (1. 4) long and 2. 0-2. 6  $\mu\text{m}$  (2. 1) wide, base of adjacent scales continuous each other, with very minute spines on each tip, partly (especially in anterior body) arranged in longitudinal rows but mostly scatter, 18-22 (20. 0) per annule in mid-body.

Head annuli two (Figs. 401, 402); first one set off, 6. 5-7. 8  $\mu\text{m}$  (7. 0) in diameter, directed posteriorly and laterally, outer margin slightly crenate, lip region convex; second one directed posteriorly, crenate, 7. 8-9. 1  $\mu\text{m}$  (8. 5) in diameter. Stylet thin, 45. 7-52. 8  $\mu\text{m}$  (50. 3) long, with anchor shaped knobs. Genital primordium oval, with two cells, 7. 2-9. 1  $\mu\text{m}$  (8. 0) long and 5. 0-6. 9  $\mu\text{m}$  (5. 8) wide. Tail conical, with eight to 11 annuli, 14. 3-18. 7  $\mu\text{m}$  (16. 4) long, terminus bluntly pointed (Fig. 404).

**Specimens examined.** *O. abies* was detected in Honshu and Hokkaido in Japan. This species was obtained from the rhizosphere of the following plants and localities; *Picea* sp. in Shibu Pass, Nagano-Gunma; *Prunus (Cerasus)* sp., *Acer japonicum* THUNB. and *Sasa* sp. in Mt. Eniwa, Hokkaido.

**Remarks.** *O. abies* distributes in the subalpine and alpine zone of Honshu and Hokkaido. This species is characterized as follows. Female 366-517  $\mu\text{m}$  in length, with 63-69 annuli. Body scales fir-leaf shaped, fringed, 44-60 per annule in mid-body. First and second head annule with long spines, equal in diameter, or the second larger than the first. Six pseudolips present in face. Stylet 92. 4-103. 1  $\mu\text{m}$  long. Vulva on 12th-17th annule from terminus. Spermatheca with spherical spermatozoa. Tail conical, with seven to nine annuli, terminus pointed. Body scale of juvenile (fourth stage) trapezoid to semicircular, with two to

five spines on each tip.

*O. abies* resembles *O. menzeli* by the spiny head annules, but distinguished from it by the longer and thinner head spines (short and thick spines in *O. menzeli*), spined second head annule (smooth and collar like in *O. menzeli*), and larger numbers of body annuli (52-60 in *O. menzeli*; TAYLOR, 1936; MEHTA & RASKI, 1971; this issue).

The type locality of *O. abies* is Mt. Yokodake, Nagano. I tried to collect topotype specimens of this species, however, *O. nemorosum* n.sp. was commonly detected there but not *O. abies*. Morphology of an only female from Shibu Pass (Table 16), 67 km north from Mt. Yokodake, is well agreed with the original description in almost all respects (ANDRÁSSY, 1979). Another population examined is from Mt. Eniwa, Hokkaido. Females of this population have two head annuli of equal diameter (Fig. 171). While females from Mt. Yokodake (original description) and Shibu Pass have larger second-head annuli comparing with the first (Fig. 170). The first head annuli of Siberian females (described as *O. villifera* by EROSHENKO, 1980; see below) are smaller than the seconds. Although the sizes of head annuli differ among population, their structures are identical with each other. These are considered to be intraspecific variations of *O. abies*.

This species is described as *Crossonema abies* based on a single female (ANDRÁSSY, 1979). In the same year, EBSARY published a description of *Crossonema capitospinosum* (= *Ogma capitospinosum*) from Canada (EBSARY, 1979). In that paper EBSARY pointed out the differences between these two species as "having two head annules, each fringed with 30 long thin spines (one head annule with about 20 short, thick spines in *C. abies*), a shorter stylet (86-99  $\mu\text{m}$  vs. 102  $\mu\text{m}$ )" and "excretory pore on annules 23-27 (annule 20 in *C. abies*)". In 1981, EBSARY showed SEM photographs of *C. capitospinosum*.

Measurements and dimensions of *O. capitospinosum* (EBSARY, 1979) are overlapping and/or comprised in those of *O. abies* presented by ANDRÁSSY (1979) and here, except for c-value (5. 2-6. 1 vs. 9. 8-12. 7), number of body annuli (63-77 vs. 63-69), stylet length (86-99  $\mu\text{m}$  vs. 92. 4-103. 1  $\mu\text{m}$ ), and numbers of spines on the first head annule (30 vs. 36-40). The last character was described 20 in number by ANDRÁSSY (1979), however, as shown in the drawing accompanied with the original description and SEM photographs in this paper, 20 spines are numbers of a half round of the annule. And that, in face view of *O. abies* and *O. capitospinosum* are almost identical (EBSARY, 1981). On the other hand, morphology and dimensions of *O. villifera* (EROSHENKO 1980) RASKI & LUC, 1987 described from Siberia are equivalent to those of *O. abies*, except for Rex (20-21 vs. 22-26) and Ran (6 vs. 7-9). Owing to the above mentioned reasons, *O. capitospinosum* and *O. villifera* are synonymized with *O. abies* here.

The SEM photographs of face views of *Criconema fimbriatum* (= *Ogma fimbriatum*) presented by DE GRISSE and LAGASSE (1969) is apparently identical with that of *O. abies* but not that species. If these specimens were obtained from a certain locality of Europe, this species also distributes in that area.

## 10. *OGMA SEGMENTUM* N.SP.

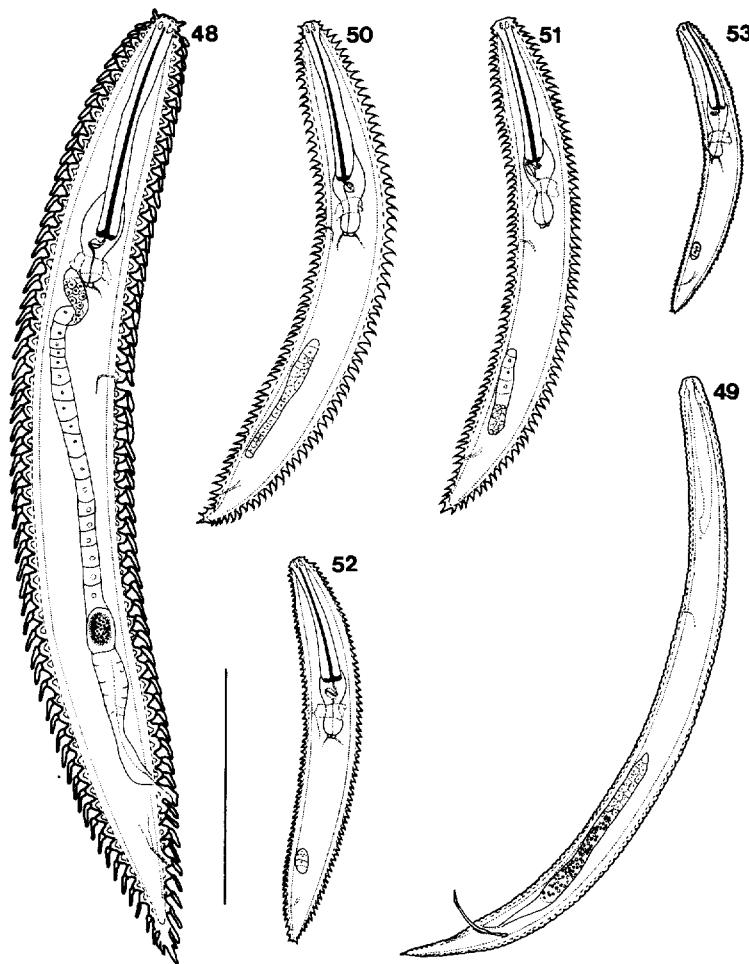
**Measurements.** Shown in Table 18 (female adult), Table 19 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 48, 81-84, 172-175, 196, 197, 210, 211, 234, 235; Table 18). Body stout, cylindrical to spindle shaped (Figs. 98, 81-84); 382-450  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body, and towards pointed tail terminus in postvulval part of body. Body annuli coarse, 59-73 in number, each bearing a continuous fringe of scales (Figs. 81-84). Scales digitate or slender spatulate, ca. 1.5  $\mu\text{m}$  wide and 5  $\mu\text{m}$  long, but rarely thin (Fig. 175); 32-34 at the first body annule, 46-76 per annule in mid-body (Figs. 196, 197), decreasing in number towards the tail terminus (Figs. 234, 235); their tips slightly directed outwards from body contour, and not neatly settled but consisted of clusters by SEM observation (Figs. 81-84).

Head annuli two, set off, small comparing to body ones (Figs. 172-174); first one waved, and crenate or shortly spined, directed to laterally and anteriorly; second one smaller than the first, smooth, collar-like. In face view, oral opening I-shaped, labial disk rounded square, enclosed in dorsal and ventral portion by connected pseudolips, which slightly swelling submedially; lateral lips semicircular, broad and flattened; submedian ones rounded, slightly smaller than lateral lips, distinctly protuberant (Figs. 151-153). Stylet thin and flexible, 72.9-102.3  $\mu\text{m}$  long; knobs anchor shaped but not sharply pointed at tips, 2.4-4.7  $\mu\text{m}$  high and 6.3-9.0  $\mu\text{m}$  across.

Excretory pore on 20th-27th annule and 97.3-148.5  $\mu\text{m}$  from anterior end, usually one to three annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, occasionally with one or two flexures near terminus; Spermatheca rounded to oval, filled with spherical spermatozoa; vagina sigmoid (Fig. 48). Vulva on 11th-15th annule from tail end; anterior vulval lip prominent, rectangular, overhanging posterior one, which broad semicircular (Figs. 210, 211). Tail conical, with five to eight annuli, 23.9-50.5  $\mu\text{m}$  long, terminus pointed (Figs. 234, 235).

*Male adult* (Figs. 49, 92, 253-256; Table 26). Body slender, ventrally arched, 289-331  $\mu\text{m}$  (mean=306  $\mu\text{m}$ , n=25) long, with 120-129 annuli (124) (Figs. 49, 92); head slightly truncated to rounded, occasionally oral part prominent (Fig. 254); tail elongated conical, terminus pointed. Body annule 2.3-2.9  $\mu\text{m}$  (2.6) apart; lateral field 3.0-4.0  $\mu\text{m}$  (3.4) wide in mid-body, widened around cloaca, with three inscures (Fig. 255). In face view, lip annule oval, oral opening pore-like, labial disk also oval, enclosed by narrow rim (Fig. 253). Esophagus weakly developed, ended at 30th-41st annule and 94.0-110.0  $\mu\text{m}$  from lip. Hemizonid on 39th-43rd annule posterior to anterior end; excretory pore on usually three to six annuli posterior to hemizonid. Testis single, well developed. Cloacal prominence weakly developed, bursa absent. Tail elongated conical, 24.0-38.7  $\mu\text{m}$  (33.5) long, with 12-17 annuli, terminus pointed and bearing minute papillae on surface (Fig. 256). Spicules arched, 31.3-38.7  $\mu\text{m}$  (33.6) long; and gubernaculum simple, rod shaped, 5.3-7.0  $\mu\text{m}$  (6.2) long.



Figs. 48-53. *Ogma segmentum* n.sp.: 48. Female adult; 49. Male adult; 50. Fourth-stage juvenile, female; 51. Do., male; 52. Third-stage juvenile; 53. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

*Fourth-stage juvenile, female* (Figs. 50, 104, 289-192; Table 19). Body stout, cylindrical to spindle shaped (Figs. 50, 104); 225-279  $\mu\text{m}$  (mean=247  $\mu\text{m}$ , n=10) long, with 64-69 annuli, bearing 10 or 11 longitudinal rows of scales at mid-body, decreasing number in both ends. Body scales in mid-body 4.7-5.7  $\mu\text{m}$  (5.3) long, and 4.0-6.0  $\mu\text{m}$  (5.2) wide at base, semicircular, with one or two, rarely three sharply pointed appendages (2.0-3.0  $\mu\text{m}$  long) on each tip (Fig. 291).

Head annuli two, set off (Fig. 290); first one with sharply pointed spines on its outer edge; second one larger than the first (9.3-11.3  $\mu\text{m}$  (10.3) vs. 10.3-12.7  $\mu\text{m}$  (11.6)), waved and crenate. In face view, oral disk rounded square; submedian lobes weakly developed and lateral lobes flat, semicircular. Stylet thin and flexible, 64.7-76.0  $\mu\text{m}$  long; knobs anchor shaped, 2.0-2.7  $\mu\text{m}$  high and 6.3-7.3  $\mu\text{m}$  across. Excretory pore on 24th-27th annule or 86.7-100.0  $\mu\text{m}$  from lip, around the level of esophagus end. Genital primordium elongated, 48.7-69.7  $\mu\text{m}$ . Tail conical, 18.0-25.3  $\mu\text{m}$  long, with seven to nine annuli, terminus pointed (Fig. 292).

*Fourth-stage juvenile, male* (Figs. 51, 105, 321-324; Table 19). Similar to the fourth-stage female-juvenile in most respects, but some differences present as follows: body more slender; stylet shorter and knobs smaller; genital primordium shorter and rounded shaped; tail longer and slender.

*Third-stage juvenile* (Figs. 52, 125, 357-360; Table 19). Genital shape and surface ornate-ments are similar to the fourth-stage female-juvenile; but body smaller, 172-210  $\mu\text{m}$  (mean=187  $\mu\text{m}$ , n=6) long; stylet shorter; knobs smaller; genital primordium less developed, oval shaped, 7.3-5.3  $\mu\text{m}$  (11.2) long and 4.3-7.0  $\mu\text{m}$  (5.6) wide; tail longer comparing to the body length (c=6.8-8.9, mean=7.8).

*Second-stage juvenile* (Figs. 53, 126, 405-408; Table 19). Body cylindrical to spindle shaped, small, 129-136  $\mu\text{m}$  (mean=134  $\mu\text{m}$ , n=10), with 69-74 annuli (71.5) (Figs. 53, 126). Body scales small, ca. 2  $\mu\text{m}$  long and 1.5  $\mu\text{m}$  wide at base, triangular in shape, with four to six very minute (0.2-0.3  $\mu\text{m}$  long) spines on each tip by SEM observation, not arranged in alternate rows but scatter, 17-25 (21.5) per annule in mid-body.

Head annuli two, not set off; first one 5.7-6.7  $\mu\text{m}$  (6.3) diameter, directed posteriorly and laterally, outer margin slightly crenate, lip region convex; second one crenate, directed laterally, 7.3-8.3  $\mu\text{m}$  (7.6) in diameter (Figs. 405, 406). Stylet thin, 37.9-42.7  $\mu\text{m}$  (40.7) long, with anchor shaped knobs. Genital primordium oval, with two cells, 6.3-8.7  $\mu\text{m}$  (7.5) long and 4.7-5.7  $\mu\text{m}$  (5.1) wide. Tail conical, with eight to ten annuli, 14.7-16.7  $\mu\text{m}$  (15.4) long, terminus bluntly pointed (Fig. 408).

**Type specimens.** Holotype female is deposited in NIAES. Paratypes: 107 females, 25 males and 100 juveniles. Paratypes of five females will be distributed to the following each institute: USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. Remaining paratypes are retained in NIAES.

**Type locality and habitat.** Holotype and paratypes were obtained from the rhizosphere of *Corylus heterophylla* FISCHER in Tsukuba, Ibaraki. This new species was also detected in the rhizosphere of the following plants and localities; *Carpinus Tschonoskii* MAXIM.

in Mt. Aso, Kumamoto; *Abies firma* SIEB. & ZUCC., *Prunus (Cerasus)* sp., *Quercus mongolica* var. *grosseserrata* (BL.) REHDER & WILSON, *Sasa* sp. and an unidentified woody plant in Misugi, Mie; *Ilex crenata* THUNB. in Mt. Norikura, Nagano; an unidentified woody plant in Mt Meshimori, Nagano; *Weigela decora* NAKAI in Komoro, Nagano; *Orixa japonica* THUNB. in Nishinasuno, Tochigi.

**Diagnosis and relationships.** *O. segmentum* n.sp. is distributing in Kyushu, Shikoku and Honshu in Japan, but not in Hokkaido. This species is characterized as follows. Female 282-450  $\mu\text{m}$  in length, with 59-73 annuli. Body scales usually digitate, fringed, 46-76 per annule in mid-body. First head annule larger than the second, crenate; second one smooth and collar-like. In face view, six pseudolips present, but lateral lips less developed comparing to others. Stylet 72.9-102.3  $\mu\text{m}$  long. Vulva on 11th-15th annule from terminus. Spermatheca with spermatozoa. Tail conical, with five to nine annuli, terminus pointed. Body scales of juvenile (fourth stage) semicircular, with spine-like appendages, one to three in number on each tip. Comparing among populations, females from Mt. Aso, Kumamoto, have thicker bodies than other population, but there are no significant differences in other respects.

*O. segmentum* n.sp. is similar to *O. menzeli* and *O. prini* n.sp. in the body scale shape, but differs in the following characters; crenate head annule (spined in *O. menzeli*; smooth in *O. prini*), not neatly arranged body scales by SEM observation (neatly arranged in both species), and larger numbers of body annuli (52-60 in *O. menzeli* (60-70 by TAYLOR, 1936) and in *O. prini*) (TAYLOR, 1936; MEHTA & RASKI, 1971; this issue).

A nematode reported as *Crossonema (Crossonema) menzeli* (= *Ogma menzeli*) from Korea by CHOI and GERAERT (1975) has the same head structure and almost identical dimensions with *O. segmentum* except for slightly larger number of RVan (6-7 vs. 2-6). This may be identified with the present new species.

## 11. OGMA PRINI N.SP.

**Measurements.** Shown in Table 20 (female adult) and Table 21 (juvenile stage).

**Descriptions.** *Female adult* (Figs. 54, 85, 86, 154-156, 176, 177, 198, 212, 213, 236, 237;

Table 20). Body stout, cylindrical to spindle shaped (Figs. 54, 85, 86); 295-460  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards pointed tail terminus in postvulval part of body. Body annuli coarse, 52-60 in number, anastomoses occasionally present especially in Kunigami populations, each bearing a continuous fringe of scales on each edge (Figs. 85, 86). Scales digitate to slender spatulate, 0.8-2.4  $\mu\text{m}$  wide and 6.5-9.9  $\mu\text{m}$  long (Fig. 148); 52-68 per annule in mid-body, decreasing in number towards the tail terminus; slightly directed outwards from body contour at their tips and neatly settled by SEM observation (Figs. 85, 86).

Head annuli usually two, rarely three (one out of 25 females examined in Kunigami populations), set off (Figs. 176, 177); small comparing to body ones; first one smooth in outer edge and waved, directed laterally and anteriorly; second one (also third when present) smaller than the first, smooth and collar-like. In face view, oral opening I-shaped; labial disk

rounded to oval; lateral lips broad and semicircular, but weakly developed; submedian lobes rounded, usually distinctly protuberant, occasionally fused to one in dorsal and/or ventral two and enclosing labial disk (Figs. 154-156). Stylet thin and flexible, 96.3-118.8  $\mu\text{m}$  long; knobs anchor shaped, 2.4-4.1  $\mu\text{m}$  high and 7.4-9.9  $\mu\text{m}$  across.

Excretory pore on 19th-23rd annule and 86.3-151.8  $\mu\text{m}$  from anterior end, around the level of esophagus end. Reproductive system well developed; ovary usually outstretched, reaching to esophagus end, occasionally with one or two flexures near terminus; spermatheca rounded to oval, without spermatozoa; vagina sigmoid (Fig. 84). Vulva usually on 10th-12th, rarely ninth or 13th annule from tail end; anterior vulval lip prominent, rectangular, overhanging posterior one, which broad semicircular, and shorter than anterior one (Figs. 212, 213). Tail conical, with usually five to seven, rarely four or eight annuli, 21.2-45.3  $\mu\text{m}$  long, terminus pointed (Figs. 236, 237).

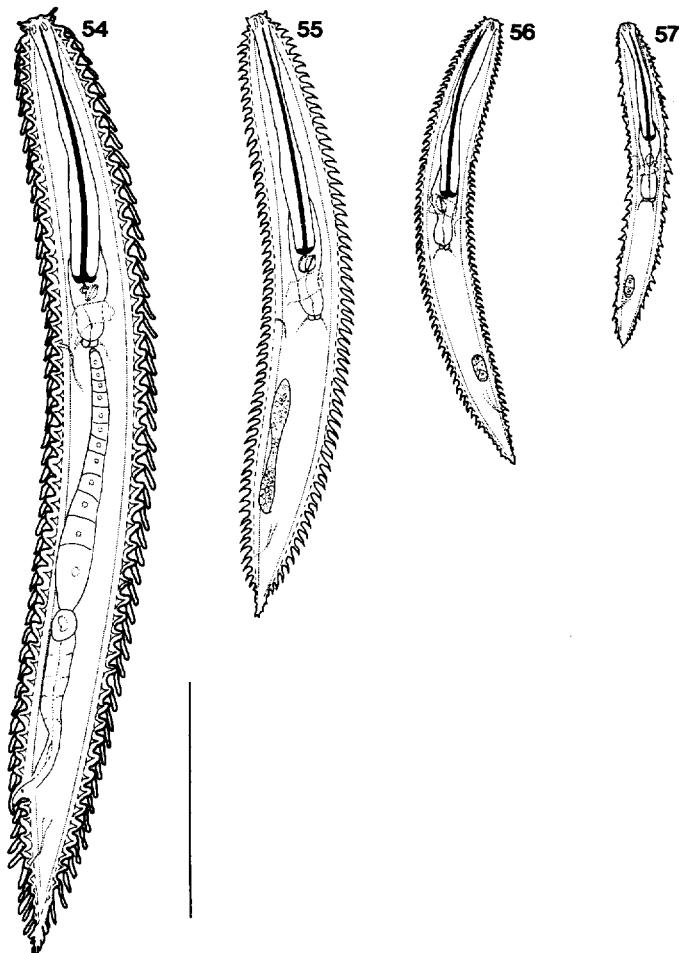
*Male adult.* Not found.

*Fourth-stage juvenile* (Figs. 55, 106, 293-296; Table 21). Body stout and cylindrical (Figs. 55, 106); slightly curved ventrally; 241-306  $\mu\text{m}$  (mean = 276  $\mu\text{m}$ , n = 10) long, with 58-65 annuli (61.4); bearing eight or nine (8.2) longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales semicircular in shape bearing membranous, spine-like appendages one to four in number on each front tip, 8.1-10.6  $\mu\text{m}$  (8.9) long and 6.5-8.1  $\mu\text{m}$  (7.4) wide at base (Fig. 295).

Head annuli two, set off (Fig. 294); first one directed laterally, outer margin waved and slightly crenate (especially in Fukuroi population), or spined (especially in Kunigami populations) with sharply pointed appendages ca. 20-25 in number, 10.6-13.0  $\mu\text{m}$  (11.6) in diameter; second one directed laterally, distinctly crenate or spined, subequal in diameter to the first, 11.4-13.0  $\mu\text{m}$  (11.9) across. In face view, oral opening I-shaped; labial disk rounded square, enclosed by ridge; submedian lobes weakly developed protuberances, and lateral lips semicircular (Fig. 293). Stylet long and thin, 83.0-105.0  $\mu\text{m}$  (92.5) long, knobs anchor shaped. Excretory pore on 22nd-25th annule from lip. Genital primordium elongated, 55.3-78.1  $\mu\text{m}$  (64.6) in length. Tail conical, 19.5-30.9  $\mu\text{m}$  (25.5) long, with seven to nine annuli (7.5), bearing membranous appendages, which broader and longer than those of mid-body, terminus bluntly pointed (Fig. 296).

*Third-stage juvenile* (Figs. 56, 127, 361-364; Table 21). General shape and surface ornate-  
ments are similar to the fourth-stage juvenile; but body smaller, 194-218  $\mu\text{m}$  (mean = 203  $\mu\text{m}$ , n = 10) long; stylet shorter; knobs slightly smaller; genital primordium less developed, oval shaped, 10.6-13.8  $\mu\text{m}$  (12.6) long and 4.9-7.3  $\mu\text{m}$  (6.6) wide.

*Second-stage juvenile* (Figs. 57, 128, 409-12; Table 21). Body cylindrical, small, 137-162  $\mu\text{m}$  (mean = 147  $\mu\text{m}$ , n = 10) long, with 58-74 (64.5) annuli (Figs. 57, 128). Body scales semi-circular, lobed, 3.3-5.2  $\mu\text{m}$  (4.1) long and 3.3-4.9  $\mu\text{m}$  (4.3) wide at base, with minute spines on each tip; arranged in alternate rows, six to ten (7.4) per annule in mid-body (Fig. 411). Head annuli two, first one set off, 6.5-8.1  $\mu\text{m}$  (7.5) diameter, directed posteriorly and laterally, outer margin slightly crenate, lip region convex; second one crenate, directed posteriorly, 8.1-9.1  $\mu\text{m}$  (8.8) in diameter (Figs. 409-410). Stylet thin, 47.1-59.3  $\mu\text{m}$  (52.8) long,



Figs. 54-57. *Ogma prini* n.sp.: 54. Female adult; 55. Fourth-stage juvenile; 56. Third-stage juvenile; 57. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

with anchor shaped knobs. Genital primordium oval, with two cells, 5.9–10.4  $\mu\text{m}$  (7.8) long and 3.9–6.5  $\mu\text{m}$  (5.2) wide. Tail conical, with seven to nine annuli (8.1), 13.0–20.9  $\mu\text{m}$  (16.9) long, terminus bluntly pointed (Fig. 412).

**Type specimens.** Holotype female is deposited in NIAES. Paratypes: 100 females and 41 juveniles. Paratypes of five females will be distributed to the following each institute; USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. The remaining paratypes are retained in NIAES.

**Type locality and habitat.** Holotype and paratypes were obtained from the rhizosphere of *Acacia confusa* MERRILL, *Elaeocarpus japonicus* SIEB. & ZUCC., *Eurya japonica* THUNB., *Ilex liukiensis* LOESEN and *Distylium racemosum* SIEB. & ZUCC. in the University Forest of the Ryukyu University, Kunigami, Okinawa; and *Persea Thunbergii* (SIEB. & ZUCC.) KOSTERMANS in Fukuroi, Shizuoka.

This species was also obtained from the rhizosphere of the following plants; in Kunigami, Okinawa: *Casuarina stricta* AIT., *Podocarpus Nagi* (THUNB.) ZOLLINGER & MORITZI, *Randia cochinchinensis* (LOUR.) MERRILL, *Symplocos microcalyx* HAYATA, *Styrax japonica* SIEB. & ZUCC., *Rhododendron Tashiroi* MAXIM., *Syzygium buxifolium* HOOK & ARNOTT, *Ilex Mutchagara* MAKINO, *Daphniphyllum Teijismannii* ZOLL., *Camellia japonica hozanensis* HAYATA and *Persea japonica* (SIEB. & ZUCC.) KOSTERM.; in Fukuroi, Shizuoka: *Ilex latifolia* THUNB. and *Quercus phillyraeoides* ASA GRAY.

**Diagnosis and relationships.** *O. prini* n.sp. commonly occurs in forest soil in Okinawa Is. and also in Shizuoka. This new species is characterized as follows. Female 295–460  $\mu\text{m}$  in length, with 52–60 annuli. Body scales digitate in shape, fringed, 52–68 per annule in mid-body. First head annule larger than the second, smooth; second one also smooth and collar-like. In face view, submedian lobes developed. Stylet 96.0–118.8  $\mu\text{m}$  long. Vulva on ninth to 13th annule from terminus. Spermatheca without spermatozoa. Tail conical, with four to eight annuli, terminus pointed. Body scales of juvenile (fourth stage) semicircular with spine-like appendages, one to four in number on each tip.

Although two localities detected *O. prini*, Okinawa and Shizuoka, are long distance from each other, morphological characters of these populations are corresponding with every respects. Variations in labial structure are present in this species as shown in Figs. 154–156, but these are observed in both populations as intraspecific variations.

This new species closely related to *O. menzeli* (STEFANSKI, 1924) SCHUURMANS STEKHOVEN & TEUNISSEN, 1938 and *O. segmentum* n.sp. by the shape and arrangement of body scales. This can be distinguished from them by the smooth head annuli (spined in *O. menzeli*; crenate in *O. segmentum*) and presence of submedian lobes in face (submedian lobes absent but six pseudolips present in the latter two species; MEHTA & RASKI, 1971; this issue).

## 12. OGMA MENZELI (STEFANSKI, 1924)

SCHUURMANS STEKHOVEN & TEUNISSEN, 1938

**References.** STEFAŃSKI, 1924 (*Hoplolaimus*); MENZEL, 1914, p. 76–78, figs. 1–4 (as *Criconema guernei*); HOFMÄNNER & MENZEL, 1914, p. 88–89, fig. 19 (as *Criconema guernei*); MENZEL,

1917, p. 157-161 (as *Hoplolaimus guernei*); MICOLETZKY, 1922, p. 577-580 (*Hoplolaimus*); MICOLETZKY, 1925, p. 296 (*Iota*); TAYLOR, 1936, p. 401, pl. 50, fig. 31-32 (*Criconema*); SCHUURMANS STEKHOVEN & TEUNISSEN, 1938, p. 7 (*Ogma*); SCHNEIDER, 1939, p. 248, fig. 453 (*Iota*); DE CONINCK, 1945, p. 27 (*Criconema*); KISCHKE, 1956, p. 258, pl. 3, fig. 3 (*Criconema*); CHITWOOD, 1957, p. 59 (*Criconema*); MEYL, 1961, p. 72, fig. 373 (*Criconema*); HOPPER, 1963, p. 595, fig. 1-4 (*Criconema*, male adult); MEHTA & RASKI, 1971, p. 163-165, fig. 4 A-G (*Crossonema* (*Crossonema*)); ANDRÁSSY, 1979, p. 51 (*Crossonema*); EBSARY, 1979, p. 2321-2324, fig. 3 B-E (*Crossonema*); EBSARY, 1981, p. 194 (*Neocrossonema*); SIDDIQI, 1986, p. 381 (*Crossonema* (*Neocrossonema*)); RASKI & LUC, 1987, p. 415 (*Ogma*); LOOF, 1988, p. 143, fig. 2 C-D (*Ogma*); BONGERS, 1988, p. 144, fig. 12. 4. 1 (*Crossonema*); EBSARY, 1991, p. 67 (*Ogma*).

**Synonym.** *Iota aculeatum* SCHNEIDER, 1939: SCHNEIDER, 1939, p. 248, fig. 454 (*Iota*); DE CONINCK, 1945, p. 27 (*Criconema*); TRAVÉ, 1954, p. 253-256, fig. 2 (*Criconema*); ANDRÁSSY, 1958, p. 40 (*Criconema*); MEYL, 1961, p. 72, fig. 371 a-c (*Criconema*); GOLDEN & FRIEDMAN, 1964, p. 58 (*Criconema*); MEHTA & RASKI, 1971, p. 166-168 (syn.).

**Measurements.** Shown in Table 22 (female adult) and Table 23 (juvenile stages).

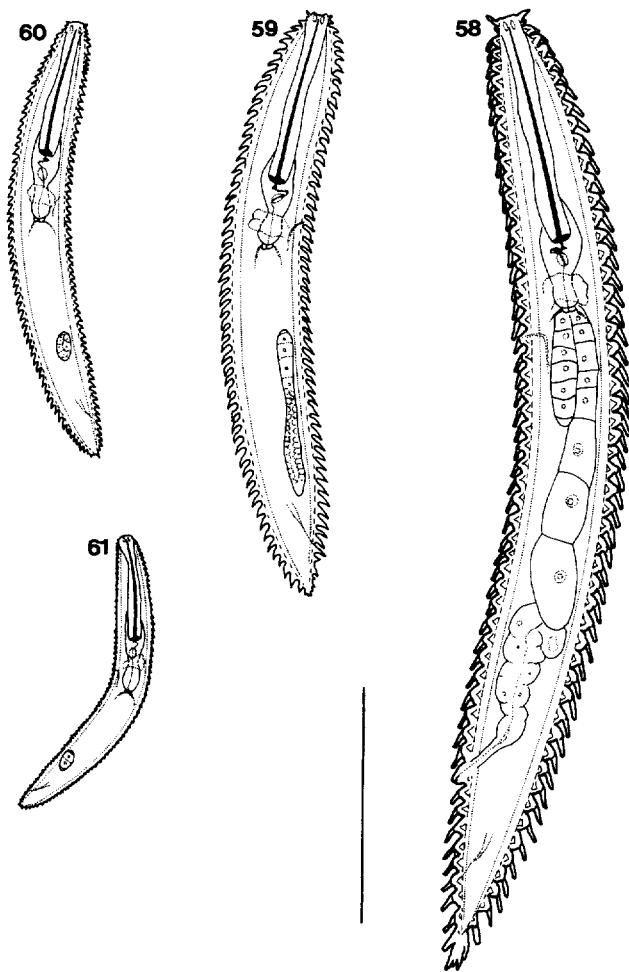
**Descriptions. Female adult** (Figs. 58, 87, 157-160, 178, 179, 199, 200, 214, 238; Table 22). Body stout, cylindrical to spindle shaped (Figs. 58, 87); 348-448  $\mu\text{m}$  long; curved ventrally after gentle heat treatment; tapering towards head in esophagus region in anterior body; and towards the pointed tail terminus in postvulval part of body. Body annule course, 52-60 in number, each bearing a continuous fringe of scales (Fig. 87). Scales digitate or slender spatulate, 1.6-3.3  $\mu\text{m}$  wide and 8.2-10.7  $\mu\text{m}$  long; 44-60 per annule in mid-body, decreasing in number towards the tail terminus.

Head annuli two, set off, small comparing to body ones (Figs. 178, 179); first one directed anteriorly, with spines, which slender, stout or irregular in shape, 16-27 in number (Figs. 157-159, 178, 179); second one smaller than the first, smooth in outer edge and collar-like shaped, occasionally waved. In face view, oral opening I-shaped, labial disk rounded, enclosed by six pseudolips, which semicircular and equal in size, arranged in hexagram around oral disk (Figs. 157-159). Stylet thin and flexible, 84.1-110.5  $\mu\text{m}$  long; knobs rounded, 2.4-4.1  $\mu\text{m}$  high and 7.4-9.0  $\mu\text{m}$  across.

Excretory pore on 18th-23rd annule, 115.5-151.8  $\mu\text{m}$  from anterior end, nought to three annuli posterior to esophagus end. Reproductive system well developed; ovary usually outstretched, occasionally with one or two flexures near terminus; spermatheca rounded to oval, without spermatozoa; vagina sigmoid (Fig. 87). Vulva on 11th-13th annule from tail end; anterior vulval lip prominent, broad triangular to semicircular, overhanging posterior one, which shallow semicircular in shape and wider than the anterior one (Fig. 214). Tail conical, with five to seven annuli, 29.7-41.2  $\mu\text{m}$  long, terminus pointed (Fig. 238).

**Male adult.** Not found.

**Fourth-stage juvenile** (Figs. 59, 107, 297-300; Table 23). Body stout, and cylindrical to spindle shaped (Figs. 59, 107); slightly curved ventrally after gentle heat treatment; 239-285  $\mu\text{m}$  (mean=260  $\mu\text{m}$ , n=10) long, with 56-62 annuli (58.2); bearing ten or 11 (10.4) longitudinal rows of scales in mid-body, decreasing in number in both ends. Body scales rounded



Figs. 58-61. *Ogma menzeli* (STEPANSKI, 1924): 58. Female adult; 59. Fourth-stage juvenile; 60. Third-stage juvenile; 61. Second-stage juvenile. Scale bar indicates 50  $\mu\text{m}$ .

triangular, with sharply-pointed spine-like appendages, two or three in number on each tip, 7.3-9.8  $\mu\text{m}$  (9.0) long and 6.5-8.1  $\mu\text{m}$  (6.9) wide at base (Fig. 299).

Head annuli two, set off (Fig. 298); first one directed anteriorly and laterally, 10.6-12.2  $\mu\text{m}$  (11.6) in diameter, crenate, with ca. 20 rounded projections, which irregular in size and interval, on outer edge; second one directed laterally, slightly larger than the first, 11.4-13.0  $\mu\text{m}$ , (12.0) across, crenate, with larger teeth comparing those of the first. In face view, oral opening I-shaped; labial disk rounded square; submedian lobes protuberant and rounded, lateral lips connected and enclosing oral disk in dorsal and ventral portions; median lips semicircular (Fig. 297). Stylet thin, 66.7-80.6  $\mu\text{m}$  (74.3) long; knobs anchor shaped. Excretory pore on 20th-24th annule from lip. Genital primordium long, 66.7-83.0  $\mu\text{m}$  (75.6) in length. Tail 21.2-30.9  $\mu\text{m}$  (24.2) long, with five to eight annuli, terminus rounded (Fig. 300).

*Third-stage juvenile* (Figs. 60, 129, 365-368; Table 23). General shape and surface ornateations are similar to the fourth-stage juvenile; but body smaller, 176-202  $\mu\text{m}$  (mean = 188  $\mu\text{m}$ , n = 7) long, with slightly larger numbers of annuli (58-66); stylet shorter; knobs smaller; genital primordium less developed, oval shaped, 14.3-19.6  $\mu\text{m}$  (16.0) long 4.6-7.2  $\mu\text{m}$  (6.3) wide.

*Second-stage juvenile* (Figs. 61, 130, 413-416; Table 23). Body cylindrical, small, 133-138  $\mu\text{m}$  (mean = 136  $\mu\text{m}$ , n = 3) long, with 63-66 (64.7) annuli (Figs. 61, 130). Body scales lobed, semicircular to rectangular, 1.3-1.6  $\mu\text{m}$  (1.4) in length and 1.3-2.0  $\mu\text{m}$  (1.5) in width, base of adjacent scales continuous each other, partly arranged in longitudinal rows but mostly scatter, 14-22 (18.0) per annule in mid-body (Fig. 415).

Head annuli two; first one set off, 6.5-6.8  $\mu\text{m}$  (6.6) in diameter, directed posteriorly and laterally, outer margin slightly crenate, lip region convex; second one crenate, directed posteriorly and laterally, 7.5-8.1  $\mu\text{m}$  (7.7) in diameter (Figs. 413, 414). Stylet thin, 40.1-43.7  $\mu\text{m}$  (41.7) long, with anchor shaped knobs. Genital primordium oval, with two cells, 7.8-9.4  $\mu\text{m}$  (8.6) long and 4.6-6.2  $\mu\text{m}$  (5.2) wide. Tail conical, with eight annuli, 10.4-15.7  $\mu\text{m}$  (12.8) long, terminus rounded (Fig. 416).

**Specimens examined.** *O. menzeli* was obtained from rhizosphere of the following plants in Sapporo, Hokkaido; *Kalopanax pictus* (THUNB.) NAKAI, *Tilia japonica* (MIQ.) SIMONKAI, *Prunus* (*Cerasus*) sp., *Sorbus americana japonica* (MAXIM.) KITAMURA, *Quercus mongolica* var. *grosseserrata* (BL.) REHDER & WILSON and *Betula platyphylla* var. *japonica* (MIQ.) HARA.

**Remarks.** In Japan, *O. menzeli* distributes only in Hokkaido. These Japanese populations are characterized as follows. Female 348-448  $\mu\text{m}$  in length, with 52-60 annuli. Body scales digitate or spatulate, fringed, 44-60 per annule in mid-body. First head annule larger than the second and spined, second one smooth or slightly crenate, collar-like. In face view, six pseudolips present. Stylet 84.1-110.5  $\mu\text{m}$  long. Vulva on 11th-13th annule from terminus. Spermatheca without spermatozoa. Tail conical, with five to seven annuli, terminus pointed. Body scales of juvenile (fourth stage) triangular to trapezoid, with spine-like appendages, one to four in number on each tip.

The remarkable character of Japanese populations of this species is morphology of the

second head annule, which is usually smooth, occasionally slightly crenate (Figs. 178, 179). According to the SEM photographies of Iowa population, the second head annule is spiny (LOOF, 1988), but shape of this annule shows quite wide range of variations (MEHTA & RASKI, 1971), such as faint crenation or deeper one to well developed blunt spines, like those of the first annule. The smooth annuli of Japanese populations are exceptional in this species, but variations of smooth and crenate head annuli found in even a single population. By these reasons, the Japanese populations are identified to *O. menzeli*, and considered to be extremely of the intraspecific variations in this species. Spines of the first head annule vary in shape even in a single Japanese population as shown in Figs. 157-159 and 178-179.

Although male adults were reported from North America (HOPPER, 1963; MEHTA & RASKI, 1971), they were not obtained in Japan. In other respects, morphological characters of the Japanese population is well agreed with those of overseas (MEHTA & RASKI, 1971).

### 13. *OGMA MICRODORUM* N.SP.

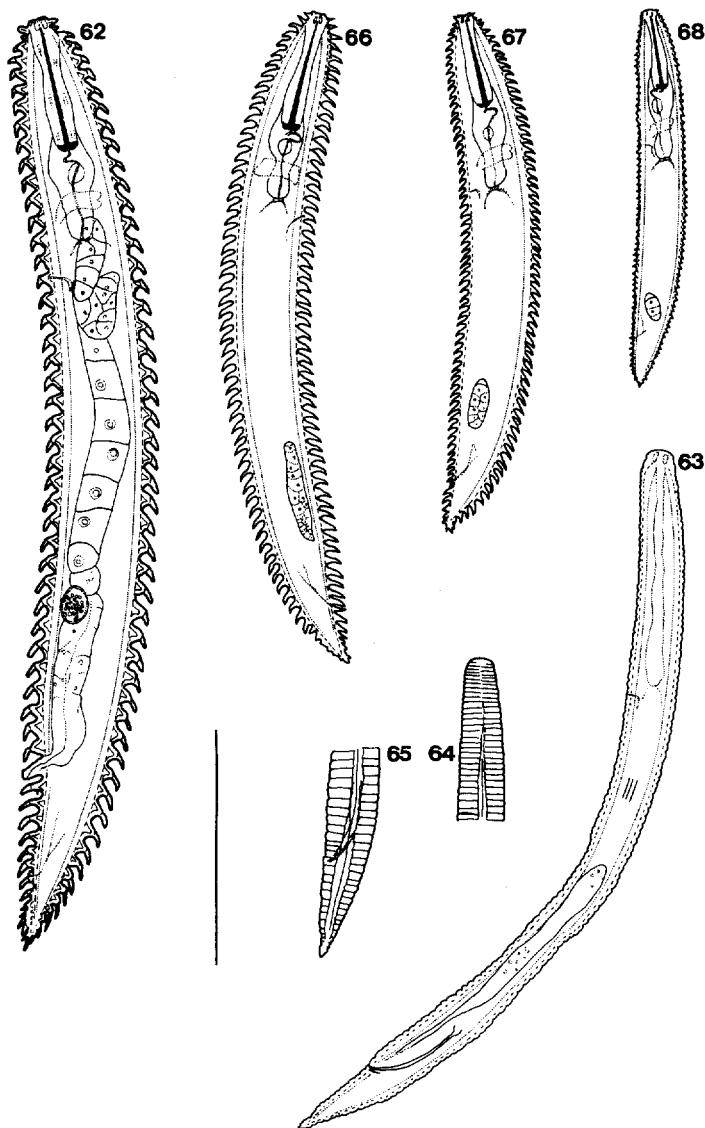
**Measurements.** Shown in Table 24 (female adult), Table 25 (juvenile stages) and Table 26 (male adult).

**Descriptions.** *Female adult* (Figs. 62, 88, 161, 162, 180, 201, 215, 216, 239, 240; Table 24). Body cylindrical,  $363\text{-}486 \mu\text{m}$  long (Figs. 62, 88); gradually decreasing body width in esophagus region towards truncate head in anterior body, and regularly tapering in postvulval region towards pointed tail terminus. Body annuli coarse, 53-60 in number, each bearing a continuous fringe of scales (Fig. 88). Scales spatulate,  $3.3\text{-}6.5 \mu\text{m}$  long, 40-52 per annule on mid-body (Fig. 201), of anterior body rounded (Fig. 180), of mid-body longer and spatulate, or slender, occasionally bifurcate, and of posterior body usually digitate (Figs. 239, 240).

Head annuli two, set off (Fig. 180); first one directed laterally and anteriorly, smooth or slightly crenate on outer edge, waved; second one smaller than first, smooth and waved. In face view, oral opening I-shaped; labial disk rounded square, enclosing in dorsal and ventral portion by six pseudolips, which similar in size and shape (Figs. 161, 162). Stylet short and straight,  $50.3\text{-}61.9 \mu\text{m}$ ; knobs anchor shaped but not sharply pointed,  $2.4\text{-}4.1 \mu\text{m}$  high and  $7.3\text{-}9.0 \mu\text{m}$  across.

Excretory pore on 16th-19th annule,  $103.4\text{-}141.6 \mu\text{m}$  posterior to lip, and usually two or three, occasionally four or five annuli posterior to esophagus terminus. Reproductive system well developed; ovary straight, occasionally with one or two flexures; spermatheca rounded, filled with spherical spermatozoa; vagina sigmoid (Fig. 62). Vulva on 11th-14th annule and  $50.5\text{-}77.5 \mu\text{m}$  anterior to tail terminus; vulval lips narrow, both shallow semi-circular and slightly pointed at their center of front edges, anterior one waved (Figs. 215, 216). Tail conical and not strongly elongated, consisting of five to eight annuli, with more slender scales comparing to those of mid-body region, terminus pointed (Figs. 239, 240).

*Male adult* (Figs. 63-65; Table 26). One male adult in the fourth-stage juvenile cuticle is available for study. Body slender, ventrally arched (Fig. 63);  $346 \mu\text{m}$  in length, with 137 annuli; head rounded (Fig. 64); annule  $4.3 \mu\text{m}$  apart; lateral field  $4.2 \mu\text{m}$  wide in mid-body.



Figs. 62-68. *Ogma microdorum* n.sp.: 62. Female adult; 63. Male adult, general view; 64. Do., anterior body; 65. Do., posterior body; 66. Fourth-stage juvenile, female; 67. Third-stage juvenile; 68. Second-stage juvenile.  
Scale bar indicates 50  $\mu\text{m}$ .

widened around cloaca, with three incisures. Esophagus 84.8  $\mu\text{m}$  long, inconspicuous. Hemizonid two annuli long, just anterior to excretory pore. Excretory pore at 90.0  $\mu\text{m}$  from lip. Cloacal prominence weakly developed, bursa absent. Tail conical, 39.4  $\mu\text{m}$  in length, with 15 annuli, terminus pointed (Fig. 65). Spicules arched and slender, 38.5  $\mu\text{m}$  long; gubernaculum simple, 6.5  $\mu\text{m}$  long.

*Fourth-stage juvenile, female* (Figs. 66, 108, 301-304; Table 25). Body cylindrical to spindle shaped (Figs. 66, 108); body annuli coarse, with ten to 12 longitudinal rows of scales at mid-body, decreasing in number towards both ends. Body scales in mid-body 4.9-9.8  $\mu\text{m}$  long, and 4.9-5.7  $\mu\text{m}$  wide at base, trapezoid, with minute tubercles two to five in number on each tip (Fig. 303).

Head annuli two, set off (Fig. 302); first one crenate with sharply pointed spines on its outer edge; second one larger than the first (11.4-13.0  $\mu\text{m}$  (mean=12.5) vs. 13.0-16.3  $\mu\text{m}$  (14.3), n=7), waved and crenate. In face view, oral disk rectangular; oral opening I-shaped; submedian lobes rounded and fused at their bases; lateral lobes semicircular, not well developed (Fig. 301). Stylet short, 44.0-50.5  $\mu\text{m}$  in length; knobs anchor shaped, 2.4-3.3  $\mu\text{m}$  high and 5.7-7.3  $\mu\text{m}$  across. Excretory pore on 18th-20th annule, 66.7-89.5  $\mu\text{m}$  from lip, around the level of esophagus end. Genital primordium elongated, 60.2-115.6  $\mu\text{m}$  (86.0) long. Tail conical, 17.1-24.4  $\mu\text{m}$  (21.9) long, with seven or eight annuli, terminus pointed (Fig. 304).

*Fourth-stage juvenile, male* (Table 25). Examination was made on the cuticle accompanied with prorhabdion of a dead juvenile of assumably male. Comparing with the fourth-stage female-juvenile, body longer (317  $\mu\text{m}$ ) and slender, with nine longitudinal rows of scales in mid-body; tail with more annuli (Ran=9); excretory pore more posteriorly located (Rex=18-20 vs. 23); but body scales and their appendages are agreed with those of female juvenile.

*Third-stage juvenile* (Figs. 67, 131, 369-372; Table 25). General shape and surface ornate-ments are similar to the fourth-stage female-juvenile; but body shorter and more slender; stylet shorter; knobs smaller; genital primordium oval, 16.3-21.2  $\mu\text{m}$  (18.4) long and 8.1-9.8  $\mu\text{m}$  (8.9) wide; scales of tail more slender (Fig. 272).

*Second-stage juvenile* (Figs. 69, 132, 417-419; Table 25). Only one juvenile of this stage available for measuring. Another molting to the third stage is shown by SEM photographs. Body spindle shaped, small, 160  $\mu\text{m}$  long (Figs. 68, 132). Body scales on posterior margin of annuli minute, 1.6  $\mu\text{m}$  long and wide, with minute spines on each tip, not arranged in longitudinal rows but scatter in mid-body (Fig. 418).

Head annuli two; first one smooth, directed posteriorly and laterally, 8.1  $\mu\text{m}$  in diameter (Fig. 417); second one crenate, directed posteriorly, 8.9  $\mu\text{m}$  diameter. Stylet 28.5  $\mu\text{m}$  long, knobs anchor shaped, 1.6  $\mu\text{m}$  high and 4.9  $\mu\text{m}$  across. Excretory pore at 24th annule or 58.6  $\mu\text{m}$  from lip. Genital primordium oval, 8.9  $\mu\text{m}$  long and 8.1  $\mu\text{m}$  wide, with two cells. Anus at 11th annule or 22.8  $\mu\text{m}$  from tail end. Tail conical, scales larger and more pointed than those of mid-body (Fig. 419).

**Type specimens.** Holotype female is deposited in NIAES. Paratypes: 84 females, one

male and 27 juveniles same data as the holotype. Paratypes of two females will be distributed to the following each institute: USDANC, UCDNC, DNRES, DNLW, IDRUG and LPMNHN. Remaining paratypes are on deposit in NIAES.

**Type locality and habitat.** Holotype and paratypes specimens were collected from rhizosphere of *Prunus (Cerasus)* sp. near the summit of Mt. Sapporo, Hokkaido.

**Diagnosis and relationships.** *O. microdorum* n.sp. distributes in the subalpine zone of Hokkaido. This new species is characterized as follows. Female 363-486 $\mu$ m in length, with 53-60 annuli. Body scales short, digitate to spatulate, occasionally bifurcate in shape, fringed, 40-52 per annule in mid-body. First head annule slightly crenate and larger than the second, which almost smooth. In face view, six pseudolips present. Stylet short, 50.3-61.9 $\mu$ m long. Vulva on 11th-14th annule from terminus. Spermatheca with spherical spermatozoa. Tail conical, with five to eight annuli, terminus pointed. Body scales of juvenile (fourth stage) trapezoidal, with two to five small papillae like appendages on each tip.

This new species is seemed to be closely related to *O. velutinum* (EROSHENKO, 1980) SIDDIQI, 1986 by the shape of body scales in female, however this can be distinguished from it by the shorter stylet (75-78 $\mu$ m in *O. velutinum*), and longer body scales (about one annule length vs. 1/2 to 1/3 width of annule). The shape of scales of *O. microdorum* n.sp. also resemble to those of *O. aquitaense* (FIES, 1968) RASKI & LUC, 1987 and *O. fimbriatum* (COBB in TAYLOR, 1936) RASKI & LUC, 1987, but its stylet is obviously shorter than those of the latters (101-120 $\mu$ m in *O. aquitaense*; 85-106 $\mu$ m in *O. fimbriatum*) (FIES, 1968; MEHTA & RASKI, 1971; ANDRÁSSY, 1979).

## DISCUSSION

In the present study on criconematid nematodes in Japan, 12 species of genus *Ogma* (*in part.: sensu* RASKI & LUC, 1987) are described and illustrated, and taxonomic position of one species (*O. japonicum*) is discussed. All of these species may belong to the genus *Ogma* (*Seriespinula*) and/or *Crossonema* (*Neocrossonema*) in the SIDDIQI's system (SIDDIQI, 1986). Although 13 species have been detected in Japan so far, most of them distributed in very limited areas. For example, *O. validum* n.sp., *O. yambaruense* n.sp., *O. menzeli* and *O. microdorum* n.sp. were respectively found in only one locality. *O. altum* n.sp., *O. abies* and *O. microdorum* n.sp. are distributing in the subalpine and alpine zone in Honshu and/or Hokkaido. *O. prini* n.sp. was only found in Okinawa and Shizuoka, the distance between the two localities is as far as 1,300 km. Whereas, such species as *O. dryum*, *O. octozonale* and *O. segmentum* n.sp. distribute widely in Japan; the first species was obtained from north (Hokkaido) to south (Kyushu), and from near the sea level to subalpine zone (Mt. Norikura). *O. menzeli*, being detected only from Hokkaido in Japan, exceptionally, has been recorded from Europe and from north America, but all the others are the species distributing in Japan and in the Far East (Table 1). Regarding a worldwide distribution of plant-parasitic nematodes, it is greatly different in distribution of *Ogma* spp. and may be other criconematid nematodes from others.

Diagnostic data of Japanese species are shown in Table 1. Species of *Ogma*, particularly

those represented in this paper, can be identified by such conspicuous morphological characters as body scales, head annuli shapes, and lip structures in females. Although these morphological characters vary to some extent among populations and sometimes even in a single population, but usually well fixed. On the other hand, dimensions (a-, b-, c- and V-value), usually employed in nematode taxonomy were not good enough to identify the Japanese criconematid species; excepting *O. microdorum* which can be identified by its significantly short stylet, and *O. japonicum* done by its larger number of body annuli (R) and larger RV (Table 1; MINAGAWA, 1984, 1988). *O. abies* and *O. segmentum* n.sp. also tend to have larger "R" than the other species, but not distinguished from each other. The face views and head annuli structures are the good morphological characteristics to distinguish the two species. Although they show a slight intra-specific variation, they are generally well fixed by the characters of body scales. Nevertheless, they may be not reflected on their phylogenetic relationships since they are different in closely allied species, which have very similar shape and structure with body scales of female adults and juveniles (fourth- and third-stage), i.e.: *O. nemorosum* n.sp. and *O. centone*; *O. dryum* and *O. yambaruense* n.sp.; *O. segmentum* n.sp., *O. prini* n.sp. and *O. menzeli*. The presence or absence of submedian lobes are once used to distinguish *Criconema (Variasquamata)* from *Crossonema* (s.l.) (MEHTA & RASKI, 1971), however, these lobes are present in four Japanese species (*O. octozonale*, *O. dryum*, *O. prini* n.sp. and *O. japonicum*) but not in others (Figs. 139, 140, 146, 155, 156).

Juvenile stages have also many useful morphological characters for the identification. Fourth- and third-stage juveniles of all Japanese species have 7-12 longitudinal rows of scales. These scales are semicircular to rectangular in shape and bearing membranous appendages, which vary in shape and size by species. These appendages can be easily observed by SEM, but difficult from the front by a optical microscope in general. Second-stage juveniles have alternated or scattered arrangements of scales which differ from the scales of other stages. Those species bearing similar scales in female adults (*O. nemorosum* n.sp. and *O. centone*; *O. dryum* and *O. yambaruense* n.sp.; *O. segmentum* n.sp. and *O. prini* n.sp.) have also similar scales in juvenile stages (fourth- and third-stage). This kinds of relations indicate the phylogenetic relations of these species.

Body scale arrangements of female adults of *cobbi*-group, once known as subgenus or genus *Seriespinula* MEHTA & RASKI, 1971, are in the form of longitudinal row, and those of *menzeli*-group, once known as genus or subgenus *Crossonema* (s.str.) MEHTA & RASKI, 1971 and/or *Neocrossonema* EBSARY, 1981, are continuous fringes. This is a good criterion to distinguish the two group in the adult stage, but not appreciable for all juvenile stages. *O. centone* shows an intermediate characteristic between *Neocrossonema* and *Seriespinula*. Regarding scale arrangements in female adults, these two genera have no critical differences already pointed out by RASKI and LUC. (1987).

Body scales (J<sub>4</sub>) of *O. civellae* and of its allies with rounded tail (= *Crossonema* (s.str.): *sensu* EBSARY, 1981) show the alternated arrangements (STEINER, 1949; MEHTA & RASKI, 1971). Japanese species of this group will be described in the next issue of this series. Classification of the species of *Ogma* and its allies, and their relationships will be discussed in detail in near future.

## ACKNOWLEDGMENT

I wish to thank Takayuki MIZUKIBO for kindly providing some nematode specimens.

## REFERENCES

- 1) ANDERSON, R. V. & MULVEY, R. H. (1979) *Plant-Parasitic Nematodes in Canada: Pt. 1. An illustrated key to the genera.* Agriculture Canada, Ottawa, 152 pp.
- 2) ANDRÁSSY, I. (1958) Erd- und Süßwassernematoden aus Bulgarien. *Acta Zool.* 4, 1-88.
- 3) ANDRÁSSY, I. (1979) Revision of the subfamily Criconematinae TAYLOR, 1936 (Nematoda). *Opusc. Zool.* Budapest, 16, 11-57.
- 4) BONGERS, T. (1988) *De Nematoden van Nederland: Een identificatietafel voor de in Nederland aangetroffen zoetwater- en bodembewonende nematoden.* Koninklijke Nederlandse Natuurhistorische Vereniging, Utrecht, 408 pp.
- 5) CATALLO, P., VOVLAS, N. & GOMEZ-BARCINA, A. (1990) Morphometrics and SEM illustrations of three species of *Ogma* SOUTHERN, 1914 (Nematoda: Criconematidae) from Spain. *J. Nematol.* 22, 560-566.
- 6) CHITWOOD, B. G. (1957) Two new species of the genus *Criconema* HOFMÄNNER and MENZEL, 1914. *Proc. Helminthol. Soc. Wash.* 24, 57-61.
- 7) CHOI, Y. E. & GERAERT, E. (1975) Criconematids from Korea with the description of eight new species (Nematoda: Tylenchida). *Nematologica* 12, 35-52.
- 8) DE CONINCK, L. A. P. (1945) Sur la variabilité de *Criconema cobbi* (MICOLETZKY, 1925) et la systématique de genre *Criconema* HOFMÄNNER & MENZEL, 1914 (Criconematinae-Nematoda) avec des données nouvelles sur quelques espèces du genre. *Bull. Mus. roy. d'Hist. nat. Belg.* 21 (24), 1-31.
- 9) DOUCET, M. E. (1981) *Seriespinula allieri* sp. n. (Criconematidae: Tylenchida). *Nematol. medit.* 9, 83-89.
- 10) EBSARY, B. A. (1979) *Crossonema capitospinosum* new species and description of *C. menzeli* and *C. fimbriatum* juveniles (Nematoda: Criconematidae). *Can. J. Zool.* 57, 2319-2324.
- 11) EBSARY, B. A. (1981) Generic revision of Criconematidae (Nematoda): *Crossonema* and related genera with a proposal for *Neocrossonema* n. gen. *Can. J. Zool.* 59, 103-114.
- 12) EBSARY, B. A. (1991) *Catalog of the order Tylenchida (Nematoda).* Agriculture Canada, Ottawa, 196 pp.
- 13) EROSHENKO, A. S. (1980) Phytopathogenic nematodes of coniferous undergrowth. I. Criconematoidea TAYLOR, 1936. In: *Kompleksnye issledovaniya lesnukh biogeotsenozov.* Vladivostok, USSR, p. 103-116 (in Russ.).
- 14) FIES, M. (1968) *Criconema aquitanense* n.sp. (Nematoda: Criconematidae). *Nematologica* 14, 47-54.
- 15) GOLDEN, A. M. & FRIEDMAN, W. (1964) Some taxonomic studies of the genus *Criconema* (Nematoda: Criconematidae). *Proc. Helminthol. Soc. Wash.* 31, 47-59.
- 16) DE GRISSE, A. & LAGASSE, A. (1969) L'utilisation du microscope électronique à balayage

dans l'étude des nématodes. J. Microscopie 8, 677-680, 5 pls.

- 17) HOFFMANN, J. K. (1973) *Criconema proclivis* n. sp. (Nematoda: Criconematinae) from woodlands. J. Nematol. 5, 155-157.
- 18) HOFMÄNNER, B. & MENZEL, R. (1914) Neue Arten freilebender Nematoden aus der Schwiz. Zool. Anz., Leipzig 44, 80-91.
- 19) HOPPER, B. E. (1963) The males of *Criconema menzeli* (STEFANSKI, 1924) TAYLOR, 1936 and *C. octangulare* (COBB, 1914) TAYLOR, 1936 (Criconematidae: Tylenchida). Can. J. Zool. 41, 595-597.
- 20) KHAN, E., CHAWLA, M. L. & SAHA, M. (1976) Criconematoidea (Nematoda: Tylenchida) from India, with descriptions of nine new species, two new genera and a family. Indian J. Nematol. 5, 70-110.
- 21) KISCHKE, U. (1956) Die Nematoden aus der Torf-Zone der Hochmoore des Obserharzen nebst Bemerkungen über gewisse Gruppen der terricolen Begleitfauna (Rotatoria, Acarina, Collembola). Arch. f. Hydrobiol. 52, 210-277.
- 22) LOOF, P. A. A. (1988) Identification of criconematids. In: *Nematode Identification and Expert System Technology* (ed. R. FORTUNER), Plenum Press, New York, pp. 139-152.
- 22) LUC, M., MAGGENTI, A. R., FORTUNER, R., RASKI, D. J. & GERAERT, E. (1987) A reappraisal of Tylenchina (Nemata) : 1. For a new approach to the taxonomy of Tylenchina. Revue Nématol. 10, 127-134.
- 23) MEHTA, U. K. & RASKI, D. J. (1971) Revision of the genus *Criconema* HOFMÄNNER and MENZEL, 1914 and other related genera (Criconematidae: Nematoda). Indian J. Nematol. 1, 145-198.
- 24) MEYL, A. H. (1961) Die freilebenden Erd- und Süßwassernematoden (Fadenwürmer). In: *Die Tierwelt Mitteleuropas*, 1 (5a). Quelle und Meyer, Leipzig, 164 pp.
- 25) MENZEL, R. (1914) Über die mikroskopische Landfauna der schweizerischen Hochalpen. Arch. Naturgesch. 80, Abt. A 3, 1-98, 1 pl.
- 26) MENZEL, R. (1917) Zur Kenntnis der freilebenden Nematodengattung *Hoplolaimus* v. DAY: Eine nomenklatorische Richtigstellung. Rev. suiss. Zool. 25, 153-162.
- 27) MICOLETZKY, H. (1922) Die freilebenden Erd-Nematoden mit besonderer Berücksichtigung der Steiermark und der Bukowina, zugleich mit einer Revision sämtlicher nicht mariner, freilebender Nematoden in Form von Genus-Beschreibungen und Bestimmungsschlusselfeln. Arch. Naturg., Berlin, Abt. A 87, 1-650.
- 28) MICOLETZKY, H. (1925) Die freilebenden Süßwaßer- und Moornematoden Dänemarks: Nebst Anhang: Über Amöbosporidien und andere Parasiten bei freilebenden Nematoden. K. Danske Vidensk. Selsk. Skr. Naturv. og Math. Afd., 8, R 10, 55-310, 13 pls.
- 29) MINAGAWA, N. (1979) Description of *Crossonema dryum* n.sp. (Criconematidae: Tylenchida) from Kumamoto, Japan. Jpn. J. Nematol. 9, 25-27.
- 30) MINAGAWA, N. (1984) A new criconematid nematode, *Pseudocriconema japonicum* n.gen et n.sp. (Tylenchida: Criconematidae) from Japan. Appl. Entomol. Zool. 19, 374-381.
- 31) MINAGAWA, N. (1986) Taxonomic studies of Criconematidae (Nematoda: Tylenchida) of Japan: I. Genera *Neolobocriconema*, *Paralobocriconema* n.gen. and *Macrocriconema* n.gen.

Bull. Natl. Inst. Agro-Environ. Sci. 1, 95-126.

32) MINAGAWA, N. (1988) Taxonomic studies of Criconematidae (Nematoda: Tylenchida) of Japan: III. Genera *Ogma* and *Pseudocriconema*. Bull. Natl. Inst. Agro-Environ. Sci. 5, 123-173.

33) MOMOTA, Y. & OHSHIMA, Y. (1974) *Crossonema octozonale* n.sp. on Japanese cedar from Japan. Jpn. J. Nematol. 4, 47-50.

34) RASKI, D. L. & LUC, M. (1987) A reappraisal of Tylenchina (Nemata): 10. The superfamily Criconematoidea TAYLOR, 1936. Revue Nématol. 10, 409-444.

35) SCHNEIDER, W. (1923) Niederrheinische freilebende Nematoden. Zool. Anz. 56, 264-281.

36) SCHNEIDER, W. (1939) Würmer oder Vermes. II. Fadenwürmer oder Nematoden. I. Freilebende und pflanzenparasitische Nematoden. In: *Tierwelt Deutschlands* 36, 260 pp.

37) SCHUURMANS STEKHOVEN, J. H., JR. & TEUNISSEN, R. J. H. (1936) Nematodes libres terrestres. Explor. Parc Natn. Albert Miss. G. F. DE WITTE (1933-1935), 22, 229 pp.

38) SIDDIQI, M. R. (1986) *Tylenchida Parasites of Plants and Insects*. Commonwealth Agricultural Bureau, Farnham Royal, 645 pp.

39) STEFAŃSKI, W. (1924) Nowy przyczynek do fauny nicieni mcholubnych okolic Zakopanego: Nouvelle contribution à la connaissance de la faune des nématodes libres des environs de Zakopane (Massif du Tatra polonais). Bull. Internat. Aca. Polon. Sc. Lett., ser. B. 7/8 539-553 (indirect citation).

40) STEINER, G. (1949) Plant nematodes the grower should know. Proc. Soil Sci. Soc. Fla 4-B, 72-117.

41) TAYLOR, A. L. (1936) The genera and species of the Criconematinae, a sub-family of the Anguillulinidae (Nematoda). Trans. Amer. Microsc. Soc. 55, 391-421.

41) TRAVÉ, J. (1954) Criconematidae (nematodes Tylenchoidea) nouveaux pour la France. Vie et Milieu, Ser. C, 5, 250-257.

42) TOIDA, Y. (1983) Criconematidae (Nematoda: Tylenchida) from soil around roots of mulberry in warm climate regions of Japan, with descriptions of two new species. Jpn. J. Nematol. 13, 14-19.

## 日本産ワセンチュウ科の分類学的研究 IV. *Ogma*属（その2）

皆川 望\*

### 摘要

本シリーズ第4報として、7新種を含む*Ogma*属の一部の12種について記載・図示するとともに、*O. japonicum*の分類学上の位置について議論を行った。本報で記載した新種は、既知種とは以下の形質で区別された。*O. nemorosum* n. sp.は、*O. cobbi*に近似するが、体環数が少なく頭部第2体環が平滑である。*O. altum* n. sp.は、*O. proclive*に似るが、体環数が少なく、口針が長い。*O. validum* n. sp.は、*O. fimbriatum*に似るが、頭部第1体環が平滑であり、口唇部の形態が異なる。*O. yambaruense* n. sp.は、*O. dryum*に似るが、頭部第1体環が平滑で体表の突起がより細い。*O. segmentum* n. sp.は、*O. menzeli*にやや似るが、体環当たりの突起が多く、頭部第1体環が鋸歯状である。*O. prini* n. sp.は、*O. segmentum*に似るが、頭部第1体環が平滑であり、口唇部にsubmedian lobeを有する。*O. microdorum* n. sp.は、*O. velutinum*に似るが、口針が長く、体環の突起が長い。以上のほか、*O. centone*及び*O. menzeli*を我が国から初めて記録し、形態を記載した。既知種である*O. octozonale*、*O. dryum*及び*O. abies*を再記載するとともに、地理的変異を検討した。*O. capitospinosum*及び*O. villidera*は、*O. abies*のシノニムとした。

---

\* 環境生物部微生物管理科

Table 1. Diagnostic data and distribution of Japanese species of *Ogma* (in part. : *sensu* Raski & Luc, 1987) (= *Ogma (Serispinula)* and *Crossonema (Neocrossonema)*: *sensu* Sioda, 1986)

Species	L. ( $\mu\text{m}$ )	R	RV	Ran	Stylet ( $\mu\text{m}$ )	Head annule		Scale Rows	Scales/ annule	Scale shape	Spores in spermatheca	Distribution (dilection) in Japan				Records from overseas
						First	Second									
<i>O. nemorosum</i>	337-462	47-54	9-13	4-8	86.6-108.0	Crenate	Smooth	Present	12-22	Triangular to rectangular	Absent	-	+	-	-	-
<i>O. centrale</i>	364-515	46-54	9-12	5-8	93.6-111.5	Crenate	Crenate	Present	12-34	Rectangular to digitate	Absent	+	-	-	-	Siberia
<i>O. octozoma</i>	337-486	54-72	9-13	5-8	99.0-116.3	Smooth	Smooth	Present	7-9	Bi-, tri- or quadri-truncate	Absent	-	+	+	+	Korea
<i>O. japonicum</i>	400-521	77-90	15-20	8-15	63.2-85.3	Crenate	Crenate	Present	10	Triangular	Present	-	+	-	+	-
<i>O. album</i>	431-645	53-63	10-14	5-8	99.0-120.5	Smooth	Smooth	Absent	38-52	Rectangular to digitate	Present	-	+	-	-	-
<i>O. validum</i>	453-542	53-59	11-15	6-7	107.2-131.1	Smooth	Crenate	Absent	40-60	Spatulate to digitate	Present	-	-	-	-	+
<i>O. dryum</i>	340-519	48-57	9-13	5-9	89.1-117.1	Crenate	Absent	20-44	Triangular to rectangular	Present	+	+	+	+	-	-
<i>O. yamashitae</i>	371-464	54-59	11-12	4-7	102.6-123.7	Smooth	Smooth	Absent	30-38	Digitate	Present	-	-	-	+	-
<i>O. abies</i>	366-517	63-69	12-17	7-9	92.4-103.1	Spined	Spined	Absent	44-60	Fir-leaf shape	Present	+	+	-	-	Canada Siberia Europe? Korea?
<i>O. segmentatum</i>	282-450	59-73	11-15	5-9	72.9-102.3	Crenate	Smooth	Absent	46-76	Digitate	Present	-	+	+	+	-
<i>O. primi</i>	295-460	52-60	9-13	4-8	96.0-118.8	Smooth	Smooth	Absent	52-68	Digitate	Absent	-	+	-	-	+
<i>O. menzeli</i>	348-448	52-60	11-13	5-7	84.1-110.5	Spined	Smooth or crenate	Absent	44-60	Digitate to spatulate	Absent	+	-	-	-	N. America Europe
<i>O. microdonum</i>	363-486	53-60	11-14	5-8	50.3-61.9	Crenate	Smooth	Absent	40-50	Spatulate to digitate	Present	+	-	-	-	-

Table 2. Measurements and dimensions of female adults of *Ogma nemorosum* n. sp.

Character	Locality		
	Mt. Norikura Nagano	Mt. Yokodake Nagano	
n	Holotype	25 (Paratypes)	10 (Paratypes)
L (μm)	425	337-462 (403±31)	335-491 (426)
a	11.4	9.7-12.7 (11.2±0.8)	9.7-12.3 (11.2)
a'	7.9	6.5-8.6 (7.5±0.5)	6.6-9.4 (7.8)
b	3.3	2.9-4.4 (3.4±0.3)	2.7-3.6 (3.1)
c	10.4	10.4-17.1 (13.4±1.9)	12.3-21.3 (16.6)
V	83.5	82.3-86.8 (84.6±1.1)	81.6-87.4 (84.8)
R	48	47-52 (49.8±1.1)	49-54 (50.7)
RV	11	10-13 (11.4±0.7)	10-13 (10.7)
Ran	7	6-8 (6.4±0.6)	5-6 (5.2)
RVan	3	3-5 (4.0±0.4)	3-7 (4.5)
Rex	17	15-17 (16.3±0.7)	16-19 (17.5)
RSt	13	12-15 (13.6±0.8)	13-17 (15.0)
ROes	16	15-18 (16.4±1.0)	16-21 (17.9)
Stylet (μm)	94.4	86.6-102.3 (94.6±4.5)	100.5-107.4 (104.5)
Prorhabdion (μm)	82.2	77.5-90.7 (84.0±3.2)	83.0-92.8 (89.5)
St. K. H. (μm)	3.3	2.4-3.3 (3.2±0.3)	2.4-4.1 (3.2)
St. K. W. (μm)	8.2	6.6-8.2 (7.5±0.7)	7.3-8.9 (7.9)
Head annule, 1st (μm)	21.2	17.3-21.4 (19.3±1.2)	17.9-22.0 (19.3)
Do., 2nd (μm)	17.3	14.8-17.3 (15.1±0.7)	14.7-17.9 (15.8)
Ex. pore/L (%)	32.2	25.3-32.5 (29.6±1.7)	28.3-34.3 (31.2)
Scales/annule	13	12-16 (13.5±1.2)	15-22 (17.8)

\* Figures indicate minimum and maximum values, and mean or mean±standard deviation in parentheses.

Table 2 (continued)

Character	Locality	
	Nakakaruizawa Nagano	Mt. Kusatus Gunma
n	10 (Paratypes)	10 (Paratypes)
L (μm)	356-410 (383)	404-462 (436)
a	9.8-12.1 (11.0)	10.0-13.4 (12.0)
a'	6.7-8.1 (7.4)	7.3-8.6 (8.0)
b	2.8-3.4 (3.2)	3.3-3.7 (3.5)
c	12.0-18.4 (14.3)	9.3-15.8 (12.4)
V	83.3-86.2 (84.8)	82.1-86.0 (84.6)
R	45-52 (48.7)	47-53 (49.8)
RV	9-12 (10.5)	10-13 (11.0)
Ran	4-7 (5.6)	5-8 (6.3)
RVan	3-5 (3.9)	3-4 (3.7)
Rex	15-18 (16.6)	15-17 (16.4)
RSt	11-15 (13.8)	13-14 (13.6)
ROes	14-18 (15.6)	15-16 (15.6)
Stylet (μm)	92.4-102.3 (97.2)	97.3-108.0 (101.8)
Prorhabdion (μm)	82.5-88.2 (85.6)	85.8-90.7 (89.1)
St. K. H. (μm)	2.4-3.3 (3.1)	2.4-3.3 (3.1)
St. K. W. (μm)	7.4-9.0 (8.0)	6.6-8.2 (7.5)
Head annule, 1st (μm)	15.6-21.4 (16.3)	18.1-21.4 (19.5)
Do., 2nd (μm)	14.8-17.3 (16.0)	14.8-16.5 (15.5)
Ex. pore/L (%)	28.5-34.3 (31.4)	29.1-32.5 (30.4)
Scales/annule	14-18 (15.5)	11-17 (13.6)

Table 3. Measurements and dimensions of juvenile stages of *Ogma nemorosum* n. sp.  
(Population from Mt. Norikura, Nagano. Paratypes)

Character	Stage		
	Fourth	Third	Second
n	10	10	8
L (μm)	229-365 (287)	163-185 (172)	143-164 (151)
a	7.1-9.8 (8.5)	7.4-9.5 (8.7)	7.0-8.5 (7.9)
a'	4.4-6.5 (5.7)	5.6-7.5 (6.3)	6.3-7.5 (7.0)
b	2.5-3.8 (2.9)	2.0-2.7 (2.2)	2.1-3.0 (2.5)
c	6.6-13.4 (9.3)	8.1-15.1 (10.8)	8.6-13.1 (10.5)
R	52-56 (54.4)	56-68 (59.1)	58-73 (64.1)
Ran	8-10 (9.0)	6-9 (8.0)	7-8 (7.6)
Rex	19-23 (20.4)	22-27 (23.6)	25-28 (26.7)
RSt	16-18 (16.8)	18-23 (20.1)	18-25 (19.9)
ROes	17-23 (20.3)	25-30 (27.6)	25-36 (27.9)
Stylet (μm)	69.3-80.8 (75.6)	48.7-61.3 (54.3)	37.3-46.0 (40.1)
Prorhabdion (μm)	61.0-69.3 (65.2)	40.0-53.3 (45.9)	32.0-38.7 (34.2)
St. K. H. (μm)	2.4-4.1 (3.3)	2.0-3.0 (2.6)	2.0-2.7 (2.2)
St. K. W. (μm)	7.4-8.2 (7.8)	5.3-6.7 (6.0)	3.3-4.3 (3.7)
Ex. pore/L (%)	31.8-38.9 (35.5)	35.1-44.7 (39.5)	36.3-44.1 (39.9)
Genit. Prim. (μm)	54.4-95.7 (71.2)	10.0-14.0 (11.5)	6.0-10.0 (7.5)
Scales/annule	10-12 (10.5)	10-12 (10.4)	14-22 (17.8)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 4. Measurements and dimensions of female adults of *Ogma centone*  
(EROSHENKO, 1980) RASKI & LUC, 1987

Character	Locality	
	Mt. Sapporo Hokkaido	Mt. Eniwa Hokkaido
n	25	25
L (μm)	364-492 (433±30)	371-515 (423±32)
a	10.9-12.6 (11.5±0.6)	8.1-13.3 (11.0±1.1)
a'	6.8-8.3 (7.6±0.5)	6.7-8.9 (7.5±0.6)
b	2.7-3.6 (3.2±0.2)	2.8-3.9 (3.3±0.3)
c	12.1-22.3 (16.7±2.8)	10.0-23.6 (15.7±2.8)
V	82.9-89.2 (85.3±1.4)	81.7-87.1 (85.3±1.2)
R	46-54 (50.4±0.6)	49-53 (50.6±1.1)
RV	10-12 (10.7±0.6)	9-11 (10.4±0.6)
Ran	4-6 (5.4±0.6)	4-7 (5.6±0.5)
RVan	3-5 (4.2±0.4)	3-5 (3.9±0.5)
Rex	15-19 (17.4±1.0)	16-19 (17.5±0.8)
RSt	13-18 (13.7±1.1)	12-16 (13.9±0.9)
ROes	15-21 (16.5±3.6)	15-19 (16.9±1.0)
Stylet (μm)	96.0-111.5 (105.6±3.6)	93.6-109.1 (101.3±3.8)
Prorhabdion (μm)	83.0-97.7 (91.3±3.5)	80.8-92.4 (87.6±3.2)
St. K. H. (μm)	2.4-4.1 (3.2±0.4)	2.4-4.1 (3.1±0.5)
St. K. W. (μm)	7.4-9.0 (8.3±0.7)	7.4-9.0 (8.2±0.7)
Head annule, 1st (μm)	17.9-22.0 (19.9±1.3)	18.1-21.4 (19.3±1.3)
Do., 2nd (μm)	14.7-17.3 (15.9±0.7)	14.8-17.3 (16.1±1.2)
Ex. pore/L (%)	31.0-36.2 (32.7±1.4)	29.3-33.9 (32.1±1.1)
Scales/annule	12-30 (21.2±3.1)	15-34 (23.0±6.2)

\* Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.

Table 5. Measurements and dimensions of juvenile stages of *Ogma centone* (EROSHENKO, 1980) RASKI & LUC, 1987 (Population from Mt. Eniwa, Hokkaido)

Character	Stage		
	Fourth	Third	Second
n	10	10	4
L (μm)	239-274 (249)	150-231 (185)	129-146 (139)
a	8.6-10.2 (9.5)	7.2-10.0 (8.4)	8.6-10.2 (9.6)
a'	5.6-6.7 (6.2)	5.6-6.7 (6.2)	7.3-8.0 (7.7)
b	2.2-2.6 (2.3)	1.9-2.6 (2.2)	1.9-2.1 (2.0)
c	9.6-13.4 (11.0)	9.3-11.9 (10.7)	9.0-11.0 (9.3)
R	52-57 (54.1)	53-59 (55.6)	62-63 (62.5)
Ran	5-7 (6.4)	5-8 (6.3)	7-9 (7.8)
Rex	19-21 (20.0)	20-23 (21.6)	25-27 (25.8)
RSt	17-21 (19.0)	18-22 (19.9)	21-22 (21.5)
ROes	21-26 (24.1)	23-29 (26.3)	30-32 (31.5)
Stylet (μm)	74.9-83.8 (78.9)	54.5-63.5 (59.2)	41.7-44.3 (43.0)
Prorhabdion (μm)	61.9-70.8 (66.0)	44.8-52.1 (49.4)	33.9-36.5 (35.2)
St. K. H. (μm)	2.4-3.3 (3.1)	1.6-2.4 (2.2)	2.0-2.3 (2.1)
St. K. W. (μm)	6.5-8.1 (7.6)	4.9-7.3 (6.3)	4.6-5.2 (5.0)
Ex. pore/L (%)	33.7-36.9 (34.9)	36.3-38.9 (37.3)	38.5-41.3 (39.7)
Genit. Prim. (μm)	47.2-70.0 (64.5)	11.4-18.9 (14.9)	6.5-8.5 (7.7)
Scales/annule	10	10	15-18 (16.3)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 6. Measurements and dimensions of female adults of *Ogma octozonale* (MOMOTA & OHSHIMA, 1974) SIDDIQI, 1986

Character	Locality		
	Mt. Aso Kumamoto	Kotohira Kagawa	Misugi Mie
n	10	10	10
L (μm)	476-441 (411)	359-486 (428)	365-431 (400)
a	11.1-12.8 (12.0)	10.6-12.6 (11.6)	9.6-11.7 (10.9)
a'	6.9-8.4 (7.6)	6.6-8.4 (7.7)	6.5-7.4 (7.1)
b	2.6-3.2 (3.0)	2.7-3.4 (3.1)	2.8-3.2 (3.1)
c	9.2-12.3 (10.2)	8.1-14.7 (10.5)	7.9-12.1 (10.6)
V	84.4-87.4 (85.6)	82.5-87.4 (85.2)	83.7-87.4 (85.8)
R	54-58 (55.7)	57-62 (58.5)	54-58 (56.5)
RV	10-12 (11.0)	11-13 (12.2)	10-12 (11.1)
Ran	6-8 (6.7)	6-8 (7.2)	5-7 (6.5)
RVan	2-4 (3.3)	3-5 (4.0)	3-5 (3.6)
Rex	19-22 (20.2)	19-23 (21.2)	19-21 (20.6)
RSt	16-19 (17.4)	15-20 (17.5)	17-19 (18.0)
ROes	19-22 (20.4)	18-23 (20.5)	19-23 (20.7)
Stylet (μm)	99.0-113.8 (110.0)	103.9-112.2 (108.2)	102.3-111.3 (107.0)
Prorhabdion (μm)	84.1-99.0 (95.6)	87.4-100.6 (94.3)	89.1-99.0 (95.1)
St. K. H. (μm)	2.4-3.3 (3.1)	2.4-3.3 (3.0)	2.4-3.3 (3.2)
St. K. W. (μm)	7.4-9.9 (8.6)	7.4-9.0 (8.2)	6.6-8.2 (8.0)
Head annule, 1st (μm)	19.9-23.1 (21.4)	18.1-24.7 (21.3)	21.4-23.1 (22.1)
Do., 2nd (μm)	14.8-18.1 (16.4)	15.6-16.5 (16.1)	14.0-18.1 (16.0)
Ex. pore/L (%)	30.8-35.0 (33.2)	31.0-34.7 (32.6)	30.2-36.0 (32.8)
Scales/annule	8	8-9 (8.2)	8

\* Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.  
(to be continued)

Table 6. (continued)

Character	Locality		
	Mt. Hamaishi Shizuoka	Nishinasuno Tochigi	Nishisenboku Akita
n	10	25	8
L (μm)	354-480 (430)	379-470 (419±20)	337-442 (376)
a	9.6-12.5 (11.4)	10.0-13.3 (11.5±0.8)	9.8-13.3 (11.3)
a'	6.9-8.3 (7.7)	6.5-8.2 (7.5±0.5)	6.1-8.1 (6.9)
b	2.8-3.4 (3.2)	2.8-3.5 (3.1±0.2)	2.5-3.4 (2.9)
c	8.9-12.8 (10.5)	8.5-14.5 (10.8±1.6)	9.4-12.9 (11.1)
V	83.0-87.5 (85.4)	83.1-88.1 (85.7±1.3)	84.0-86.9 (85.2)
R	56-60 (57.7)	55-61 (57.3±1.5)	54-60 (57.0)
RV	10-13 (11.1)	9-13 (10.9±0.9)	9-11 (9.8)
Ran	5-7 (5.9)	5-8 (6.1±0.8)	3-6 (4.8)
RVan	3-5 (4.2)	3-5 (3.8±0.6)	4
Rex	16-20 (18.0)	19-23 (21.1±1.1)	21-24 (22.1)
RSt	19-23 (20.9)	15-19 (17.8±1.1)	17-20 (19.0)
ROes	20-23 (21.2)	17-22 (20.5±1.3)	20-24 (22.1)
Stylet (μm)	100.6-110.5 (106.9)	99.0-116.3 (109.0±3.9)	105.8-112.3 (108.6)
Prorhabdion (μm)	89.1-95.7 (92.2)	87.4-99.3 (94.1±3.4)	96.0-103.4 (99.0)
St. K. H. (μm)	2.4-3.3 (3.1)	2.4-3.3 (2.9±0.5)	2.4-3.3 (3.2)
St. K. W. (μm)	6.6-9.0 (8.1)	7.4-9.0 (8.4±0.5)	7.3-8.9 (8.0)
Head annule, 1st (μm)	20.7-23.9 (22.0)	19.9-24.7 (22.1±1.3)	19.5-22.8 (21.0)
Do., 2nd (μm)	15.5-19.9 (17.8)	14.8-18.9 (17.1±1.1)	14.7-18.7 (16.3)
Ex. pore/L (%)	30.0-34.9 (31.9)	29.7-37.1 (32.5±1.4)	30.8-36.3 (34.7)
Scales/annule	8	8-9 (8.04±0.2)	7-8 (7.9)

Table 7. Measurements and dimensions of juvenile stages of *Ogma octozonale* (MOMOTA & OHSHIMA, 1974) SIDDIQI, 1986 (Population from Nishinasuno, Tochigi)

Character	Stage		
	Fourth	Third	Second
n	10	10	10
L (μm)	261-330 (289)	157-198 (185)	119-146 (140)
a	6.8-9.9 (8.5)	6.7-10.8 (9.0)	7.9-10.4 (9.5)
a'	4.8-6.0 (5.3)	5.5-6.4 (6.0)	6.0-7.3 (6.5)
b	2.2-3.0 (2.5)	1.7-2.1 (2.0)	1.8-2.2 (2.0)
c	7.8-13.2 (11.3)	8.3-15.2 (10.0)	6.6-10.9 (8.6)
R	57-66 (61.9)	61-69 (64.2)	60-69 (64.3)
Ran	6-9 (7.4)	6-10 (8.3)	6-10 (7.9)
Rex	22-27 (25.2)	23-30 (26.4)	26-31 (28.4)
RSt	19-26 (23.2)	24-29 (26.5)	23-26 (24.6)
ROes	23-30 (26.7)	29-37 (29.6)	31-38 (34.3)
Stylet (μm)	84.7-100.3 (95.0)	68.7-79.2 (75.2)	44.0-52.0 (49.3)
Prorhabdion (μm)	79.3-84.7 (82.6)	58.0-68.7 (63.9)	36.7-45.3 (41.5)
St. K. H. (μm)	2.3-3.3 (2.7)	2.0-2.7 (2.4)	2.0-2.7 (2.2)
St. K. W. (μm)	7.0-8.2 (7.6)	6.0-6.7 (6.4)	4.7-5.3 (5.1)
Ex. pore/L (%)	34.1-42.9 (37.9)	39.3-48.1 (42.0)	40.7-46.5 (42.7)
Genit. Prim. (μm)	49.5-91.3 (63.9)	9.3-12.7 (10.6)	6.3-8.7 (7.3)
Scales/annule	10-12 (10.3)	8-10 (9.8)	8-9 (8.2)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 8. Measurements and dimensions of female adults of *Ogma altum* n. sp.

Character	Locality		
	Mt. Norikura Nagano	Mt. Yatsugatake Nagano	
n	Holotype	25 (Paratypes)	25 (Paratypes)
L (μm)	568	431-645 (540±61)	487-640 (555±40)
a	12.9	9.6-14.2 (11.3±1.2)	9.4-13.8 (11.6±1.0)
a'	8.3	6.5-9.5 (7.7±0.8)	6.6-9.1 (7.8±0.7)
b	3.2	3.0-5.3 (3.8±0.5)	3.3-4.3 (3.7±0.3)
c	13.7	10.5-14.7 (12.7±1.8)	11.0-16.1 (13.8±1.7)
V	83.1	81.6-88.2 (84.1±1.5)	80.1-86.3 (83.4±1.6)
R	62	55-63 (57.8±1.7)	53-58 (55.3±1.3)
RV	12	11-14 (12.0±0.8)	10-13 (11.3±0.9)
Ran	6	6-8 (6.4±0.6)	5-6 (5.5±0.5)
RVan	5	4-6 (4.6±0.7)	4-6 (4.8±0.6)
Rex	22	18-21 (19.7±0.7)	17-20 (18.3±0.9)
RSt	17	12-17 (14.5±1.3)	13-16 (14.2±0.9)
ROes	23	15-20 (17.7±1.6)	15-19 (17.3±1.2)
Stylet (μm)	115.5	99.0-115.5 (110.4±4.1)	107-120.5 (113.3±4.1)
Prorhabdion (μm)	102.3	89.1-102.3 (96.9±3.5)	91.2-105.8 (98.8±5.1)
St. K. H. (μm)	4.9	4.1-4.9 (4.6±0.4)	3.3-6.5 (4.9±0.7)
St. K. W. (μm)	11.4	8.2-12.3 (9.6±0.9)	8.9-13.0 (11.4±0.9)
Head annule, 1st (μm)	26.8	24.7-29.7 (26.9±1.0)	26.0-30.1 (27.7±1.0)
Do., 2nd (μm)	19.5	18.1-23.1 (19.7±1.4)	17.9-27.7 (21.3±2.0)
Ex. pore/L (%)	29.2	28.8-34.8 (31.0±1.3)	25.9-31.1 (28.7±1.4)
Scales/annule	48	38-52 (45.2±3.4)	45-60 (50.4±3.6)

\*Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.

Table 9. Measurements and dimensions of juvenile stages of *Ogma altum* n. sp. (Population from Mt. Norikura, Nagano. Paratypes)

Character	Stage		
	Fourth		Third
	Female	Male	
n	10	8	6
L (μm)	299-425 (362)	300-417 (368)	201-281 (213)
a	9.4-11.5 (10.5)	10.6-14.8 (12.7)	9.6-10.2 (10.0)
a'	6.0-9.2 (7.1)	6.7-9.3 (7.8)	6.7-7.1 (6.9)
b	2.7-3.3 (3.0)	2.7-3.5 (3.1)	2.3-3.0 (2.6)
c	7.5-11.5 (9.2)	6.6-10.6 (8.4)	7.5-8.9 (8.2)
R	60-65 (62.6)	59-66 (62.9)	62-69 (65.8)
Ran	7-10 (8.4)	7-10 (8.5)	9-10 (9.5)
Rex	20-23 (21.7)	21-24 (22.3)	23-26 (24.5)
RSt	14-21 (18.5)	14-20 (16.9)	18-21 (19.6)
ROes	19-27 (23.0)	20-26 (22.5)	21-27 (25.5)
Stylet (μm)	75.9-95.7 (89.1)	77.5-87.4 (83.7)	52.7-73.3 (67.5)
Prorhabdion (μm)	69.4-84.1 (77.4)	67.6-75.9 (71.3)	43.3-64.7 (57.6)
St. K. H. (μm)	2.7-4.9 (3.9)	3.3-4.9 (3.7)	2.7-4.0 (3.2)
St. K. W. (μm)	7.3-9.9 (8.9)	7.2-9.3 (8.3)	6.3-8.7 (7.6)
Ex. pore/L (%)	28.0-34.7 (32.2)	21.9-33.8 (31.0)	34.5-40.4 (36.5)
Genit. Prim. (μm)	35.3-89.1 (63.4)	33.3-74.2 (49.3)	10.0-23.3 (15.4)
Scales/annule	10	8-9 (8.4)	9-11 (10.0)

\*Figures indicate minimum and maximum values, and mean in parentheses.

Table 10. Measurements and dimensions of female adults of *Ogma validum* n. sp.

Character	Locality	
	Kunigami, Okinawa	
n	Holotype	25 (Paratypes)
L ( $\mu\text{m}$ )	490	453-542 (501±26)
a	11.9	10.0-14.2 (12.2±1.1)
a'	8.5	7.5-9.3 (8.5±0.5)
b	3.2	3.0-3.6 (3.3±0.2)
c	11.9	8.7-12.8 (10.6±1.2)
V	82.2	80.1-84.7 (81.9±1.1)
R	56	53-59 (56.2±1.6)
RV	12	11-15 (12.5±0.8)
Ran	6	6-7 (6.5±0.5)
RVan	5	4-6 (5.0±0.7)
Rex	19	18-23 (20.0±1.2)
RSt	15	14-17 (15.4±1.0)
ROes	19	18-21 (19.3±1.0)
Stylet ( $\mu\text{m}$ )	111.3	107.2-131.1 (114.7±4.5)
Prorhabdion ( $\mu\text{m}$ )	98.3	92.4-115.5 (99.1±4.6)
St. K. H. ( $\mu\text{m}$ )	5.7	4.1-6.6 (5.1±0.5)
St. K. W. ( $\mu\text{m}$ )	11.5	10.7-14.0 (12.7±0.8)
Head annule, 1st ( $\mu\text{m}$ )	23.9	21.4-26.4 (24.1±1.3)
D <sub>o.</sub> , 2nd ( $\mu\text{m}$ )	22.2	18.1-22.2 (20.3±1.4)
Ex. pore/L (%)	31.5	28.3-33.5 (31.3±1.6)
Scales/annule	50	40-60 (45.4±5.0)

\* Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.

Table 11. Measurements and dimensions of juvenile stages of *Ogma validum* n. sp. (Paratypes)

Character	Stage		
	Fourth		Second
	Female	Male	
n	10	5	6
L ( $\mu\text{m}$ )	245-417 (381)	334-345 (341)	193-259 (232)
a	8.4-10.7 (9.4)	11.1-13.0 (12.1)	7.9-9.9 (8.8)
a'	5.5-7.1 (6.3)	7.2-8.2 (7.7)	5.8-6.6 (6.2)
b	2.8-3.2 (3.0)	2.9-3.1 (3.0)	1.9-2.7 (2.3)
c	8.7-12.0 (10.6)	7.6-10.9 (8.7)	7.9-10.8 (8.8)
R	56-60 (58.0)	58-61 (59.8)	57-63 (61.0)
Ran	6-7 (6.8)	6-9 (7.8)	7-9 (7.7)
Rex	21-23 (21.8)	22-23 (22.4)	24-28 (26.3)
RSt	16-18 (16.9)	17-18 (17.6)	20-27 (21.7)
ROes	20-23 (21.7)	21-26 (23.0)	26-32 (28.6)
Stylet ( $\mu\text{m}$ )	91.2-99.3 (94.9)	78.1-88.7 (84.3)	68.4-78.1 (72.2)
Prorhabdion ( $\mu\text{m}$ )	76.5-86.4 (81.2)	66.7-76.5 (74.4)	57.0-67.6 (61.7)
St. K. H. ( $\mu\text{m}$ )	3.3-4.9 (4.4)	4.1	3.3-4.1 (3.6)
St. K. W. ( $\mu\text{m}$ )	10.6-13.0 (11.2)	8.9-10.7 (9.6)	8.1-9.8 (8.5)
Ex. pore/L (%)	31.5-37.6 (34.1)	31.1-36.2 (33.2)	37.2-40.5 (39.3)
Genit. Prim. ( $\mu\text{m}$ )	70.0-123.7 (93.8)	55.3-78.1 (67.7)	14.7-29.3 (19.9)
Scales/annule	8-10 (9.1)	8	8-9 (8.5)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 12. Measurements and dimensions of female adults of *Ogma dryum* (MINAGAWA, 1979)  
RASKI & LUC, 1987

Character	Locality		
	Nishigoshi Kumamoto	Mt. Aso Kumamoto	Misugi Mie
n	50 (Topotypes)	40	10
L ( $\mu\text{m}$ )	356-519 (433±36)	340-514 (421±41)	382-434 (413)
a	9.5-14.4 (11.8±0.9)	8.9-13.2 (10.8±1.3)	10.5-13.2 (11.3)
a'	6.8-10.1 (8.3±0.7)	6.4-9.8 (7.5±0.8)	6.3-8.5 (8.4)
b	2.9-4.0 (3.4±0.3)	2.7-3.6 (3.2±0.2)	3.1-3.6 (3.3)
c	8.5-21.8 (14.1±2.6)	8.4-16.8 (11.1±1.8)	8.6-13.0 (11.2)
V	82.8-89.8 (85.3±1.5)	82.5-87.9 (84.4±1.3)	81.0-85.7 (83.9)
R	50-55 (52.8±1.3)	49-56 (52.7±1.6)	50-54 (51.9)
RV	10-13 (11.1±0.7)	10-12 (11.0±0.6)	10-12 (10.7)
Ran	5-9 (5.8±0.8)	5-7 (6.2±0.6)	5-6 (5.6)
RVan	1-5 (4.3±0.7)	3-5 (3.9±0.5)	3-5 (4.1)
Rex	17-20 (18.8±0.8)	17-21 (18.9±1.0)	18-20 (18.7)
RSt	11-15 (13.6±1.1)	13-18 (14.7±1.0)	15-18 (15.9)
ROes	14-20 (16.9±1.2)	16-22 (17.7±1.3)	17-19 (17.6)
Stylet ( $\mu\text{m}$ )	89.1-114.6 (99.8±5.4)	91.5-117.1 (106.2±7.4)	97.3-116.2 (108.4)
Prorhabdion ( $\mu\text{m}$ )	77.5-100.6 (88.5±4.3)	80.8-100.6 (92.7±5.7)	89.1-103.2 (96.1)
St. K. H. ( $\mu\text{m}$ )	2.4-3.3 (2.9±0.4)	2.4-3.3 (2.9±0.4)	2.4-3.3 (2.9)
St. K. W. ( $\mu\text{m}$ )	7.4-9.0 (8.4±0.4)	6.2-9.0 (8.2±0.6)	7.4-8.2 (8.0)
Head annule, 1st ( $\mu\text{m}$ )	18.1-23.9 (21.5±1.1)	16.5-23.9 (16.8±1.3)	21.4-23.1 (22.6)
Do., 2nd ( $\mu\text{m}$ )	14.8-19.9 (16.9±1.0)	14.0-21.4 (16.8±1.4)	16.5-18.1 (16.8)
Ex. pore/L (%)	30.2-36.9 (33.4±1.3)	29.7-37.4 (33.9±1.5)	30.4-34.5 (32.6)
Scales/annule	22-36 (31.3±3.3)	24-44 (30.8±6.2)	28-32 (29.2)

\* Figures indicate minimum and maximum values, and mean or mean±standard deviation in parentheses.

Table 12. (continued)

Character	Locality		
	Mt. Norikura Nagano	Tsukuba Ibaraki	Nishinasuno Tochigi
n	10	10	10
L ( $\mu\text{m}$ )	346-448 (391)	358-443 (395)	352-451 (399)
a	10.8-13.4 (11.9)	9.6-12.8 (11.6)	10.6-13.0 (11.4)
a'	7.0-8.9 (7.9)	6.5-8.4 (7.9)	7.1-8.4 (7.7)
b	2.8-3.6 (3.2)	2.7-3.5 (3.1)	3.1-3.5 (3.3)
c	9.4-13.2 (11.4)	9.0-13.6 (11.6)	9.0-13.3 (11.2)
V	82.9-86.0 (84.2)	83.0-85.8 (84.5)	81.4-86.6 (84.6)
R	52-53 (52.6)	50-53 (51.3)	48-57 (52.5)
RV	10-11 (10.7)	10-11 (10.4)	9-11 (10.7)
Ran	5-6 (5.6)	5-6 (5.5)	5-7 (6.0)
RVan	4-5 (4.1)	3-4 (3.9)	3-4 (3.7)
Rex	17-19 (18.9)	17-20 (18.1)	17-19 (18.3)
RSt	13-17 (15.5)	14-17 (15.1)	14-16 (15.6)
ROes	16-20 (18.2)	17-20 (18.1)	16-19 (18.0)
Stylet ( $\mu\text{m}$ )	89.1-107.2 (101.5)	97.3-110.5 (102.5)	97.3-107.2 (101.9)
Prorhabdion ( $\mu\text{m}$ )	79.2-99.0 (91.1)	82.5-94.2 (89.5)	85.8-95.7 (90.6)
St. K. H. ( $\mu\text{m}$ )	2.4-3.3 (2.7)	2.4-3.3 (2.9)	2.4-3.3 (2.7)
St. K. W. ( $\mu\text{m}$ )	6.6-9.0 (7.6)	7.4-9.0 (8.3)	7.4-8.2 (7.8)
Head annule, 1st ( $\mu\text{m}$ )	18.1-21.4 (19.4)	19.9-23.1 (21.6)	14.0-23.9 (20.6)
Do., 2nd ( $\mu\text{m}$ )	14.8-17.3 (15.7)	15.6-18.9 (16.7)	15.6-18.9 (17.2)
Ex. pore/L (%)	31.0-35.4 (33.4)	30.0-34.4 (32.4)	28.2-31.9 (30.7)
Scales/annule	20-28 (24.0)	26-36 (30.4)	24-32 (28.0)

(to be continued)

Table 12. (continued)

Character	Locality
	Sapporo Hokkaido
n	10
L ( μm)	363-469 (426)
a	10.6-13.9 (12.5)
a'	7.0-8.8 (8.3)
b	2.7-3.6 (3.2)
c	9.7-15.7 (13.5)
V	83.4-87.4 (86.2)
R	48-53 (51.2)
RV	9-11 (9.7)
Ran	4-6 (4.7)
RVan	4
Rex	18-19 (18.4)
RSt	14-18 (15.3)
ROes	16-21 (17.7)
Stylet ( μm)	98.5-114.0 (107.4)
Prorhabdion ( μm)	86.3-100.9 (94.0)
St. K. H. ( μm)	2.4-3.3 (3.0)
St. K. W. ( μm)	8.1-9.9 (8.6)
Head annule, 1st ( μm)	19.5-22.0 (20.9)
Do., 2nd ( μm)	15.5-17.9 (16.7)
Ex. pore/L (%)	31.6-37.3 (33.2)
Scales/annule	24-30 (27.4)

Table 13. Measurements and dimensions of juvenile stages of *Ogma dryum* (MINAGAWA, 1979) RASKI & LUC, 1987 (Population from Nishigoshi, Kumamoto. Topotypes)

Character	Stage		
	Fourth		Third
	Female	Male	Second
n	10	3	10
L ( μm)	235-280 (260)	249-395 (267)	172-210 (187)
a	8.3-11.5 (9.7)	11.6-12.3 (11.9)	8.0-10.0 (9.2)
a'	5.3-6.5 (5.9)	6.1-7.4 (6.7)	5.6-7.8 (6.2)
b	2.1-2.6 (2.3)	2.5-3.1 (2.8)	1.8-2.3 (2.0)
c	8.5-11.0 (9.0)	6.6-9.4 (7.7)	6.8-8.9 (7.8)
R	54-64 (58.0)	56-62 (59.3)	59-62 (60.8)
Ran	7-10 (8.1)	9-10 (9.3)	8-9 (8.5)
Rex	21-26 (24.5)	23-25 (24.3)	22-27 (24.4)
RSt	20-23 (21.9)	17-20 (18.3)	21-27 (24.2)
ROes	24-30 (26.4)	23-25 (23.7)	27-34 (30.7)
Stylet ( μm)	80.0-92.4 (84.9)	71.7-77.5 (75.6)	66.0-76.0 (69.3)
Prorhabdion ( μm)	68.7-84.1 (74.8)	59.4-66.7 (64.3)	54.7-65.3 (58.8)
St. K. H. ( μm)	2.7-3.3 (2.9)	2.4-3.3 (2.7)	2.3-3.0 (2.7)
St. K. W. ( μm)	7.0-8.0 (7.5)	6.6-7.4 (7.1)	5.3-6.7 (6.2)
Ex. pore/L (%)	36.3-45.3 (39.8)	34.2-39.1 (36.8)	35.6-41.7 (37.5)
Genit. Prim. ( μm)	46.7-68.4 (54.9)	19.9-33.8 (27.2)	7.3-15.3 (11.2)
Scales/annule	8-11 (9.6)	7-9 (8.0)	9-11 (9.6)
			7-10 (7.8)

\*Figures indicate minimum and maximum values, and mean in parentheses.

Table 14. Measurements and dimensions of female adults of *Ogma yambaruense* n. sp.

Character	Locality	
	Kunigami, Okinawa	
n	Holotype	25 (Paratypes)
L (μm)	431	371-464 (415±26)
a	12.9	11.1-13.7 (12.4±0.8)
a'	8.1	7.5-9.1 (8.5±0.5)
b	3.1	2.8-3.3 (3.0±0.1)
c	18.9	11.3-20.6 (13.8±2.4)
V	86.8	82.2-87.0 (84.4±1.1)
R	55	54-59 (56.0±1.3)
RV	11	11-12 (11.3±0.5)
Ran	5	4-7 (5.5±0.7)
RVan	5	4-6 (4.8±0.6)
Rex	20	20-22 (21.1±0.8)
RSt	17	17-19 (17.8±0.8)
ROes	20	19-23 (20.9±1.1)
Stylet (μm)	116.4	102.6-123.7 (114.1±5.1)
Prorhabdion (μm)	102.6	89.5-107.4 (99.8±4.7)
St. K. H. (μm)	3.3	2.4-3.3 (3.2±0.3)
St. K. W. (μm)	8.1	7.3-9.0 (8.2±0.5)
Head annule, 1st (μm)	17.9	17.9-21.4 (19.6±1.1)
Ds., 2nd (μm)	14.7	13.0-16.5 (14.9±0.8)
Ex. pore/L (%)	33.2	31.6-35.8 (33.5±1.3)
Scales/annule	34	30-38 (33.2±2.0)

\* Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.

Table 15. Measurements and dimensions of juvenile stages of *Ogma yambaruense* n. sp. (Paratypes)

Character	Stage		
	Fourth	Third	Second
n	10	7	4
L (μm)	252-316 (278)	177-233 (195)	136-155 (144)
a	9.8-11.2 (10.3)	8.6-12.5 (9.9)	8.2-9.5 (8.9)
a'	5.6-8.0 (6.5)	6.4-6.9 (6.7)	6.9-7.7 (7.3)
b	2.0-2.7 (2.3)	1.8-2.4 (2.1)	1.8-2.3 (2.0)
c	10.1-12.5 (11.3)	7.6-10.1 (9.1)	6.9-9.8 (8.7)
R	58-64 (60.9)	59-65 (63.0)	62-68 (64.5)
Ran	7-8 (7.2)	7-9 (8.1)	8-10 (8.8)
Rex	22-26 (23.7)	23-27 (25.7)	25-28 (26.7, n=3)
RSt	20-25 (23.0)	22-27 (24.4, n=5)	25 (n=2)
ROes	24-30 (26.9)	26-34 (30.0)	32-36 (33.8)
Stylet (μm)	91.2-100.9 (96.3)	61.9-72.4 (68.4, n=5)	48.5-50.9 (49.4, n=3)
Prorhabdion (μm)	78.1-86.3 (82.5)	53.7-65.1 (58.9)	40.4-43.0 (41.7)
St. K. H. (μm)	2.4-3.3 (2.9)	2.4-3.3 (2.6, n=5)	2.0-2.3 (2.1, n=3)
St. K. W. (μm)	7.3-8.9 (8.0)	5.7-7.3 (6.3, n=5)	3.3-5.5 (4.7, n=3)
Ex. pore/L (%)	33.7-40.0 (36.7)	34.4-40.0 (38.2)	36.5-41.9 (39.9, n=3)
Genit. Prim. (μm)	52.1-78.1 (61.9)	8.1-22.8 (15.0)	7.2-7.8 (7.5)
Scales/annule	8-9 (8.4)	8-10 (8.6)	18-22 (20.0)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 16. Measurements and dimensions of female adults of *Ogma abies* (ANDRÁSSY, 1979) RASKI & LUC, 1987

Character	Locality	
	Shibu Pass Gunma-Nagano	Mt. Eniwa Hokkaido
n	1	25
L ( $\mu\text{m}$ )	422	366-517 (447±33)
a	11.1	9.8-12.9 (11.7±0.7)
a'	8.0	7.2-9.2 (8.1±0.5)
b	3.8	2.6-3.8 (3.3±0.2)
c	8.3	9.8-12.7 (11.5±0.9)
V	79.3	82.0-85.2 (83.5±0.9)
R	67	63-69 (66.2±1.4)
RV	15	12-17 (14.4±1.0)
Ran	9	7-9 (8.2±0.7)
RVan	5	4-7 (5.2±0.7)
Rex	23	22-26 (23.4±0.8)
RSt	18	16-19 (17.6±1.1)
ROes	21	20-26 (22.3±1.4)
Stylet ( $\mu\text{m}$ )	102.3	92.4-103.1 (98.3±3.7)
Prorhabdion ( $\mu\text{m}$ )	90.7	75.9-89.1 (84.8±3.8)
St. K. H. ( $\mu\text{m}$ )	4.9	2.4-4.1 (3.5±0.4)
St. K. W. ( $\mu\text{m}$ )	9.9	8.2-9.9 (8.6±0.5)
Head annule, 1st ( $\mu\text{m}$ )	18.1	15.6-21.4 (19.3±1.4)
Do., 2nd ( $\mu\text{m}$ )	23.1	15.6-21.4 (19.3±1.2)
Ex. pore/L (%)	28.5	29.3-34.8 (31.9±1.4)
Scales/annule	46	44-60 (50.6±4.9)

\* Figures indicate minimum and maximum values, and mean  $\pm$  standard deviation in parentheses.

Table 17. Measurements and dimensions of juvenile stages of *Ogma abies* (ANDRÁSSY, 1979) RASKI & LUC, 1987 (Population from Mt. Eniwa, Hokkaido)

Character	Stage		
	Fourth		Second
	Female	Male	
n	8	1	10
L ( $\mu\text{m}$ )	262-351 (286)	290	189-234 (213)
a	8.3-10.3 (9.1)	11.2	7.7-10.0 (9.0)
a'	6.2-7.0 (6.6)	6.2	6.1-7.7 (7.0)
b	2.4-3.0 (2.6)	2.7	2.0-2.5 (2.2)
c	10.3-13.3 (10.6)	9.4	7.9-10.6 (9.2)
R	63-73 (69.3)	69	70-76 (72.7)
Ran	8-10 (8.6)	10	8-11 (9.7)
Rex	24-27 (25.3)	27	27-31 (29.4)
RSt	19-22 (20.4)	22	23-26 (24.5)
ROes	24-29 (26.1)	28	23-26 (24.5)
Stylet ( $\mu\text{m}$ )	73.3-93.0 (81.1)	76.5	60.2-68.0 (64.9)
Prorhabdion ( $\mu\text{m}$ )	63.5-73.3 (69.0)	65.0	50.5-60.2 (55.5)
St. K. H. ( $\mu\text{m}$ )	3.3-4.1 (3.5)	3.3	2.4-3.3 (2.7)
St. K. W. ( $\mu\text{m}$ )	6.5-8.9 (7.7)	6.8	6.5-7.3 (6.8)
Ex. pore/L (%)	33.8-39.7 (36.7)	37.6	33.8-45.8 (38.5)
Genit. Prim. ( $\mu\text{m}$ )	48.8-104.2 (67.4)	53.7	13.0-17.9 (15.5)
Scales/annule	10-12 (10.9)	10	10-12 (11.1)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 18. Measurements and dimensions of female adults of *Ogma segmentum* n. sp.

Character	Locality		
	Mt. Aso Kumamoto	Misugi Mie	Mt. Norikura Nagano
n	16 (Paratypes)	10 (Paratypes)	10 (Paratypes)
L (μm)	282-407 (359)	340-406 (367)	353-394 (371)
a	6.6-10.1 (8.1)	9.8-11.5 (10.7)	10.2-12.1 (11.1)
a'	5.3-6.6 (6.1)	6.4-8.2 (7.2)	6.8-8.0 (7.3)
b	2.5-3.8 (3.2)	3.1-3.4 (3.3)	3.2-3.7 (3.4)
c	7.7-12.6 (10.4)	8.8-14.6 (11.5)	9.0-13.8 (10.8)
V	81.1-85.5 (83.4)	81.5-87.7 (84.7)	82.1-86.1 (83.6)
R	62-66 (63.9)	63-68 (65.1)	61-64 (62.3)
RV	11-14 (12.6)	11-14 (12.7)	11-13 (11.6)
Ran	6-9 (7.8)	6-9 (7.6)	5-7 (6.4)
RVan	2-6 (3.8)	4-5 (4.1)	3-5 (4.2)
Rex	21-26 (23.9)	23-26 (23.8)	21-23 (22.2)
RSt	16-22 (18.4)	17-20 (18.2)	16-18 (16.8)
ROes	20-27 (22.8)	20-24 (21.6)	20-22 (22.9)
Stylet (μm)	72.9-91.6 (86.1)	84.0-92.4 (87.6)	76.5-92.0 (83.3)
Prorhabdion (μm)	64.7-80.5 (75.3)	69.7-80.8 (75.1)	66.7-75.7 (72.1)
St. K. H. (μm)	2.4-4.7 (3.0)	2.4-3.3 (2.6)	2.4-3.1 (3.0)
St. K. W. (μm)	6.3-7.9 (7.0)	6.6-8.2 (7.7)	6.5-8.9 (7.5)
Head annule, 1st (μm)	12.6-17.4 (15.0)	15.6-18.9 (17.1)	14.7-17.1 (16.3)
Do., 2nd (μm)	11.1-15.8 (12.9)	13.2-15.6 (13.9)	13.0-14.7 (13.7)
Ex. pore/L (%)	31.0-38.7 (34.4)	32.0-34.9 (34.0)	28.6-34.9 (31.3)
Scales/annule	62-74 (66.3)	52-72 (61.6)	46-58 (51.8)

\* Figures indicate minimum and maximum values, and mean or mean ± standard deviation in parentheses.

Table 18. (continued)

Character	Locality		
	Mt. Meshimori Nagano	Tsukuba Ibaraki	Shiobara Tochigi
n	10 (Paratypes)	Holotype	25 (Paratypes)
L (μm)	310-396 (375)	402	302-450 (374±30)
a	9.0-10.9 (10.2)	11.8	9.4-12.5 (11.2±0.8)
a'	5.7-7.7 (7.0)	8.2	6.1-8.3 (7.3±0.5)
b	2.9-3.8 (3.4)	3.6	2.7-4.0 (3.3±0.3)
c	9.9-13.0 (11.7)	11.8	9.3-12.8 (10.5±0.9)
V	82.1-85.8 (84.1)	85.0	80.3-85.4 (83.3±1.2)
R	59-62 (60.6)	63	60-73 (62.8±2.6)
RV	11-13 (12.4)	11	11-15 (12.3±0.9)
Ran	6-8 (6.9)	6	6-8 (6.8±0.7)
RVan	4-5 (4.5)	4	4-6 (4.5±0.7)
Rex	21-23 (22.1)	24	21-27 (23.1±1.4)
RSt	16-18 (16.7)	17	15-22 (17.9±1.7)
ROes	17-22 (19.7)	20	18-25 (20.9±1.6)
Stylet (μm)	80.0-94.0 (88.7)	86.3	82.5-102.3 (89.4±4.5)
Prorhabdion (μm)	70.9-82.5 (77.6)	76.3	74.2-87.4 (79.4±3.3)
St. K. H. (μm)	2.4-3.3 (2.7)	2.4	2.4-4.1 (3.0±0.5)
St. K. W. (μm)	6.6-8.2 (7.6)	7.3	6.6-9.0 (7.8±0.6)
Head annule, 1st (μm)	15.6-18.1 (16.7)	17.9	14.8-18.9 (16.7±1.3)
Do., 2nd (μm)	13.2-17.3 (14.4)	13.8	13.2-15.6 (14.3±0.8)
Ex. pore/L (%)	32.4-36.7 (34.1)	34.5	29.1-36.6 (32.9±1.8)
Scales/annule	54-66 (59.6)	56	48-76 (57.8±6.6)

Table 19. Measurements and dimensions of juvenile stages of *Ogma segmentum* n. sp.  
(Population from Tsukuba, Ibaraki. Paratypes)

Character	Stage			
	Fourth		Third	
	Female	Male		
n	10	10	10	10
L (μm)	225-279 (247)	202-267 (228)	160-183 (172)	129-138 (134)
a	8.4-10.4 (9.0)	9.5-11.8 (10.5)	6.7-8.5 (7.7)	7.8-9.3 (8.7)
a'	5.7-6.9 (6.4)	6.7-8.4 (7.3)	5.0-6.4 (6.0)	7.0-8.7 (7.8)
b	2.5-2.8 (2.6)	2.6-3.3 (2.9)	2.2-2.5 (2.3)	2.1-2.2 (2.14)
c	10.2-13.0 (11.8)	7.3-8.9 (8.0)	8.7-10.1 (9.6)	8.1-9.4 (8.7)
R	64-69 (66.3)	64-67 (66.7)	68-70 (68.3)	69-74 (71.5)
Ran	7-9 (7.7)	8-9 (8.7)	8-9 (8.5)	8-10 (9.0)
Rex	23-27 (25.2)	24-27 (25.5)	27-29 (27.9)	29-32 (30.3)
RSt	19-21 (20.0)	16-22 (19.1)	21-24 (22.6)	22-25 (23.5)
ROes	24-27 (25.6)	22-28 (25.3)	29-33 (30.2)	33-36 (34.6)
Stylet (μm)	64.7-76.0 (71.3)	54.0-62.0 (57.4)	48.7-56.7 (52.8)	37.9-42.7 (40.7)
Prorhabdion (μm)	56.7-64.0 (61.0)	47.3-53.3 (49.5)	40.7-47.3 (44.6)	30.7-35.3 (33.7)
St. K. H. (μm)	2.0-2.7 (2.4)	2.0-2.7 (2.3)	1.7-2.7 (2.1)	1.7-2.3 (1.9)
St. K. W. (μm)	6.3-7.3 (6.8)	5.0-6.3 (5.8)	5.3-6.0 (5.8)	4.7-5.3 (4.8)
Ex. pore/L (%)	34.9-38.5 (37.5)	33.5-36.7 (35.3)	38.3-40.4 (39.7)	39.1-44.2 (41.2)
Genit. Prim. (μm)	48.7-69.7 (57.0)	15.3-44.7 (28.8)	11.3-16.7 (13.7)	6.3-8.7 (7.5)
Scales/annule	10-11 (10.7)	9-10 (9.2)	10-11 (10.8)	17-25 (21.2)

\*Figures indicate minimum and maximum values, and mean in parentheses.

Table 20. Measurements and dimensions of female adults of *Ogma prini* n. sp.

Character	Locality		
	Kunigami Okinawa	Holotype	Fukuroi Shizuoka
n		25 (Paratypes)	25 (Paratypes)
L (μm)	400	346-460 (406±29)	295-440 (365±36)
a	12.9	11.3-15.0 (12.8±1.0)	10.1-14.3 (11.6±1.1)
a'	7.9	7.6-10.0 (8.8±0.6)	7.0-12.2 (8.0±1.1)
b	3.0	2.5-3.3 (2.9±0.2)	2.5-3.1 (2.7±0.2)
c	12.3	8.7-18.0 (11.7±2.3)	8.2-13.2 (10.7±1.3)
V	85.4	81.9-88.0 (84.5±1.5)	82.2-88.1 (85.6±1.6)
R	56	54-60 (57.4±1.9)	52-59 (55.7±1.9)
RV	11	10-13 (11.5±0.9)	9-12 (11.1±0.9)
Ran	5	5-8 (6.3±0.7)	4-7 (6.1±0.8)
RVan	5	3-5 (4.2±0.5)	3-5 (4.0±0.5)
Rex	21	20-23 (21.4±0.8)	19-23 (21.3±0.9)
RSt	18	17-21 (18.6±1.2)	17-24 (19.5±2.2)
ROes	21	19-24 (21.6±1.4)	20-27 (22.9±2.0)
Stylet (μm)	108.2	99.3-117.1 (110.0±4.9)	96.0-118.8 (107.3±5.2)
Prorhabdion (μm)	94.4	86.3-100.6 (96.0±3.9)	83.1-103.9 (93.1±4.9)
St. K. H. (μm)	3.3	2.4-3.3 (3.2±0.2)	2.4-4.1 (3.3±0.4)
St. K. W. (μm)	8.1	7.4-9.0 (8.3±0.4)	8.1-9.9 (8.5±0.6)
Head annule, 1st (μm)	18.7	16.3-20.7 (17.6±1.1)	16.5-20.7 (18.9±1.2)
Do., 2nd (μm)	16.3	14.7-17.9 (15.2±0.7)	13.8-16.5 (15.4±0.8)
Ex. pore/L (%)	34.1	30.5-37.6 (33.5±1.4)	29.3-37.1 (33.0±2.3)
Scales/annule	58	52-68 (59.5±4.5)	52-59 (55.7±1.9)

\*Figures indicate minimum and maximum values, and mean±standard deviation in parentheses.

Table 21. Measurements and dimensions of juvenile stages of *Ogma prini* n. sp. (Population from Kunigami, Okinawa. Paratypes)

Character	Stage		
	Fourth	Third	Second
n	10	10	10
L (μm)	241-306 (276)	194-218 (203)	137-162 (147)
a	9.4-11.4 (10.2)	9.5-11.0 (10.4)	8.4-10.8 (9.5)
a'	6.8-7.7 (7.0)	6.7-8.0 (7.2)	6.1-7.4 (6.7)
b	2.1-2.7 (2.3)	1.8-2.2 (2.0)	1.8-2.0 (1.8)
c	9.0-12.4 (10.9)	8.0-11.3 (9.5)	6.6-10.8 (8.9)
R	58-65 (61.4)	59-67 (63.7)	58-64 (62.0)
Ran	7-9 (7.5)	7-9 (8.1)	7-9 (8.1)
Rex	22-25 (24.3)	25-28 (24.8)	24-31 (28.1)
RSt	20-26 (22.6)	23-29 (25.9)	21-30 (24.5)
ROes	25-32 (28.6)	29-37 (32.5)	31-40 (34.6)
Stylet (μm)	83.0-105.0 (92.5)	68.4-84.7 (76.2)	47.1-59.3 (52.8)
Prorhabdion (μm)	71.6-91.2 (79.8)	58.6-71.6 (65.4)	39.1-50.2 (45.2)
St. K. H. (μm)	2.4-3.3 (2.9)	2.4-3.3 (2.8)	2.0-2.4 (2.2)
St. K. W. (μm)	7.3-8.1 (7.8)	6.5-8.1 (7.1)	4.6-5.9 (5.3)
Ex. pore/L (%)	34.1-39.2 (36.8)	36.3-41.9 (38.3)	38.0-46.1 (43.4)
Genit. Prim. (μm)	55.3-78.1 (64.6)	10.6-13.8 (12.6)	5.9-10.4 (7.8)
Scales/annule	8-9 (8.2)	8-11 (8.4)	6-10 (7.4)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 22. Measurements and dimensions of female adults of *Ogma menzeli* (STEFANSKI, 1924)  
RASKI & LUC, 1987

Character	Locality	
	Sapporo, Hokkaido	
n	25	
L (μm)	348-448 (390±24)	
a	10.5-13.4 (11.7±0.8)	
a'	6.7-8.9 (7.8±0.6)	
b	2.8-3.5 (3.1±0.2)	
c	9.2-14.9 (11.6±1.3)	
V	77.7-83.4 (81.2±1.3)	
R	52-60 (56.4±1.9)	
RV	11-13 (12.3±0.5)	
Ran	5-7 (5.8±0.5)	
RVan	4-7 (5.5±0.6)	
Rex	18-23 (20.5±1.2)	
RSt	14-18 (16.1±1.1)	
ROes	18-22 (19.3±1.3)	
Stylet (μm)	84.1-110.5 (95.6±5.3)	
Prorhabdion (μm)	70.9-95.7 (83.6±5.1)	
St. K. H. (μm)	2.4-4.1 (3.2±0.4)	
St. K. W. (μm)	7.4-9.0 (8.2±0.4)	
Head annule, 1st (μm)	14.0-19.9 (17.2±1.8)	
Do., 2nd (μm)	13.2-15.6 (13.9±0.8)	
Ex. pore/L (%)	31.2-35.2 (32.9±1.1)	
Scales/annule	44-60 (49.4±4.2)	

\* Figures indicate minimum and maximum values, and mean ± standard deviation in parentheses.

Table 23. Measurements and dimensions of juvenile stages of *Ogma menzeli* (STEFANSKI, 1924) RASKI & LUC, 1987 (Population from Sapporo, Hokkaido)

Character	Stage		
	Fourth	Third	Second
n	10	7	3
L ( $\mu\text{m}$ )	239-285 (261)	176-202 (188)	133-138 (136)
a	7.3-10.8 (9.6)	7.6-9.1 (8.5)	8.2-9.7 (9.1)
a'	5.1-7.4 (6.4)	5.7-7.0 (6.4)	7.0-8.5 (7.8)
b	2.3-2.8 (2.5)	2.1-2.4 (2.3)	2.0-2.5 (2.2)
c	8.9-12.6 (10.9)	8.9-11.7 (10.6)	8.7-13.3 (10.9)
R	56-62 (58.2)	58-66 (62.3)	63-66 (64.7)
Ran	5-8 (6.8)	6-8 (7.0)	8
Rex	20-24 (21.8)	23-27 (25.3)	24-27 (25.0)
RSt	15-22 (18.3)	19-23 (20.9)	20-21 (20.5)
ROes	20-27 (23.7)	26-33 (28.7)	24-30 (27.3)
Stylet ( $\mu\text{m}$ )	66.7-80.0 (74.3)	53.7-58.0 (55.3)	40.1-43.7 (41.7)
Prorhabdion ( $\mu\text{m}$ )	57.0-70.0 (64.1)	45.0-48.9 (46.8)	33.3-37.2 (35.2)
St. K. H. ( $\mu\text{m}$ )	2.4-4.1 (3.2)	2.0-3.3 (2.5)	2.0-2.3 (2.1)
St. K. W. ( $\mu\text{m}$ )	6.5-8.9 (7.6)	5.5-6.5 (6.0)	4.6-5.2 (4.9)
Ex. pore/L (%)	33.3-37.4 (35.7)	35.8-42.2 (38.2)	39.7-44.1 (41.2)
Genit. Prim. ( $\mu\text{m}$ )	66.7-83.0 (75.6)	14.3-19.6 (16.0)	7.8-9.4 (8.6)
Scales/annule	10-11 (10.4)	9-12 (11.1)	14-20 (18.0)

\* Figures indicate minimum and maximum values, and mean in parentheses.

Table 24. Measurements and dimensions of female adults of *Ogma microdorum* n. sp.

Character	Locality	
	Mt. Sapporo, Hokkaido	
n	Holotype	25 (Paratypes)
L ( $\mu\text{m}$ )	456	363-486 (431 $\pm$ 36)
a	13.3	10.9-14.3 (12.6 $\pm$ 0.9)
a'	9.0	7.7-10.1 (8.7 $\pm$ 0.6)
b	4.8	3.9-5.0 (4.5 $\pm$ 0.3)
c	20.0	13.2-21.5 (16.7 $\pm$ 2.9)
V	86.8	83.3-87.0 (85.0 $\pm$ 1.2)
R	56	53-60 (55.8 $\pm$ 2.0)
RV	12	11-14 (12.5 $\pm$ 0.9)
Ran	6	5-8 (6.5 $\pm$ 0.7)
RVan	5	4-6 (5.0 $\pm$ 0.5)
Rex	17	16-19 (16.9 $\pm$ 1.0)
RSt	9	9-11 (9.9 $\pm$ 0.7)
ROes	12	12-17 (13.9 $\pm$ 1.1)
Stylet ( $\mu\text{m}$ )	52.9	50.3-61.9 (56.9 $\pm$ 3.1)
Prorhabdion ( $\mu\text{m}$ )	42.3	39.6-50.5 (45.8 $\pm$ 2.5)
St. K. H. ( $\mu\text{m}$ )	3.3	2.4-4.1 (3.5 $\pm$ 0.5)
St. K. W. ( $\mu\text{m}$ )	8.1	7.3-9.0 (8.1 $\pm$ 0.4)
Head annule, 1st ( $\mu\text{m}$ )	19.5	14.0-22.5 (19.9 $\pm$ 1.6)
Do., 2nd ( $\mu\text{m}$ )	17.9	14.7-18.1 (16.0 $\pm$ 0.9)
Ex. pore/L (%)	31.1	25.9-31.8 (27.8 $\pm$ 1.3)
Scales/annule	45	40-52 (45.0 $\pm$ 2.7)

\* Figures indicate minimum and maximum values, and mean  $\pm$  standard deviation in parentheses.

Table 25. Measurements and dimensions of juvenile stages of *Ogma microdorum* n. sp. (Paratypes)

Character	Stage		
	Fourth		Third
	Female	Male <sup>1)</sup>	
n	7	1	5
L (μm)	220-300 (272)	317	191-223 (206)
a	8.1-11.5 (8.5)	12.2	9.1-10.5 (9.8)
a'	5.7-7.2 (6.4)	7.9	6.5-7.2 (6.8)
b	2.9-3.8 (3.4)	-	2.8-3.0 (2.9)
c	10.0-15.2 (12.2)	7.5	8.4-10.2 (9.4)
R	57-62 (59.3)	60	61-63 (62.0)
Ran	7-8 (7.4)	9	8-9 (8.2)
Rex	18-20 (18.9)	23	21-24 (22.0)
RSt	11-14 (12.3)	-	13-15 (13.8)
ROes	17-20 (17.8)	-	21-24 (22.2)
Stylet (μm)	44.0-50.5 (48.5)	-	35.8-39.1 (37.4)
Prorhabdion (μm)	35.0-40.7 (38.5)	37.4	27.7-30.9 (29.5)
St. K. H. (μm)	2.4-3.3 (3.0)	-	2.4-3.3 (2.6)
St. K. W. (μm)	5.7-7.3 (6.7)	-	6.5
Ex. pore/L (%)	27.1-34.3 (30.1)	37.4	30.6-34.1 (32.8)
Genit. Prim. (μm)	60.2-115.6 (86.0)	-	16.3-21.2 (18.4)
Scales/annule	10-12 (10.7)	9	9-12 (10.8)

\* Figures indicate minimum and maximum values, and mean in parentheses.

<sup>1)</sup> Examination was made on the cuticle accompanied with a prorhabdion of assumably a male juvenile.Table 26. Measurements and dimensions of male adults of *Ogma* spp.

Character	Species and locality		
	<i>O. altum</i> n. sp. Mt. Norikura Nagano	<i>O. validum</i> n. sp. Kunigami Okinawa	<i>O. dryum</i> Nishigoshi Kumamoto
n	15 (Paratypes)	3 (Paratypes)	25 (Topotypes)
L (μm)	440-513 (475±22)	398-461 (424)	337-391 (365±13)
a	17.3-22.0 (18.7±1.2)	16.0-19.6 (17.5)	14.6-18.7 (16.9±1.0)
b	3.6-5.3 (4.2±0.4, n=13)	3.5-4.0 (3.7)	3.5-4.7 (4.0±0.3)
c	8.6-11.7 (9.4±0.8)	9.7-16.5 (12.0)	6.9-9.2 (7.8±0.5)
c'	2.4-3.1 (2.7±0.3)	1.5-2.6 (2.2)	2.7-4.2 (3.4±0.3)
R	91-125 (111.4±8.9)	108-109 (108.7)	104-124 (109±4.0)
Rex	34-42 (37.5±2.0)	39-43 (41.3)	33-44 (39.1±1.9)
Rhem	32-40 (35.7±2.4)	36-39 (37.7)	32-40 (36.8±2.1)
ROes	32-37 (34.9±1.8, n=13)	34-40 (36.3)	29-39 (32.9±2.2)
Ran	13-16 (14.5±1.1)	12-21 (16.0)	12-18 (14.7±1.6)
Ex. pore/L (%)	23.8-29.5 (26.7±1.5)	27.5-32.3 (30.3)	27.3-33.6 (30.8±1.6)
T (%)	22.4-47.0 (37.0±6.0)	28.1-35.9 (31.8)	20.2-44.9 (35.8±6.9)
Spicules (μm)	43.3-60.0 (53.1±4.1)	35.9-39.8 (38.3)	34.3-42.7 (37.3±1.8)
Gubernaculum (μm)	9.3-11.7 (10.4±0.6)	8.2-8.5 (8.4)	6.7-8.3 (7.8±0.5)

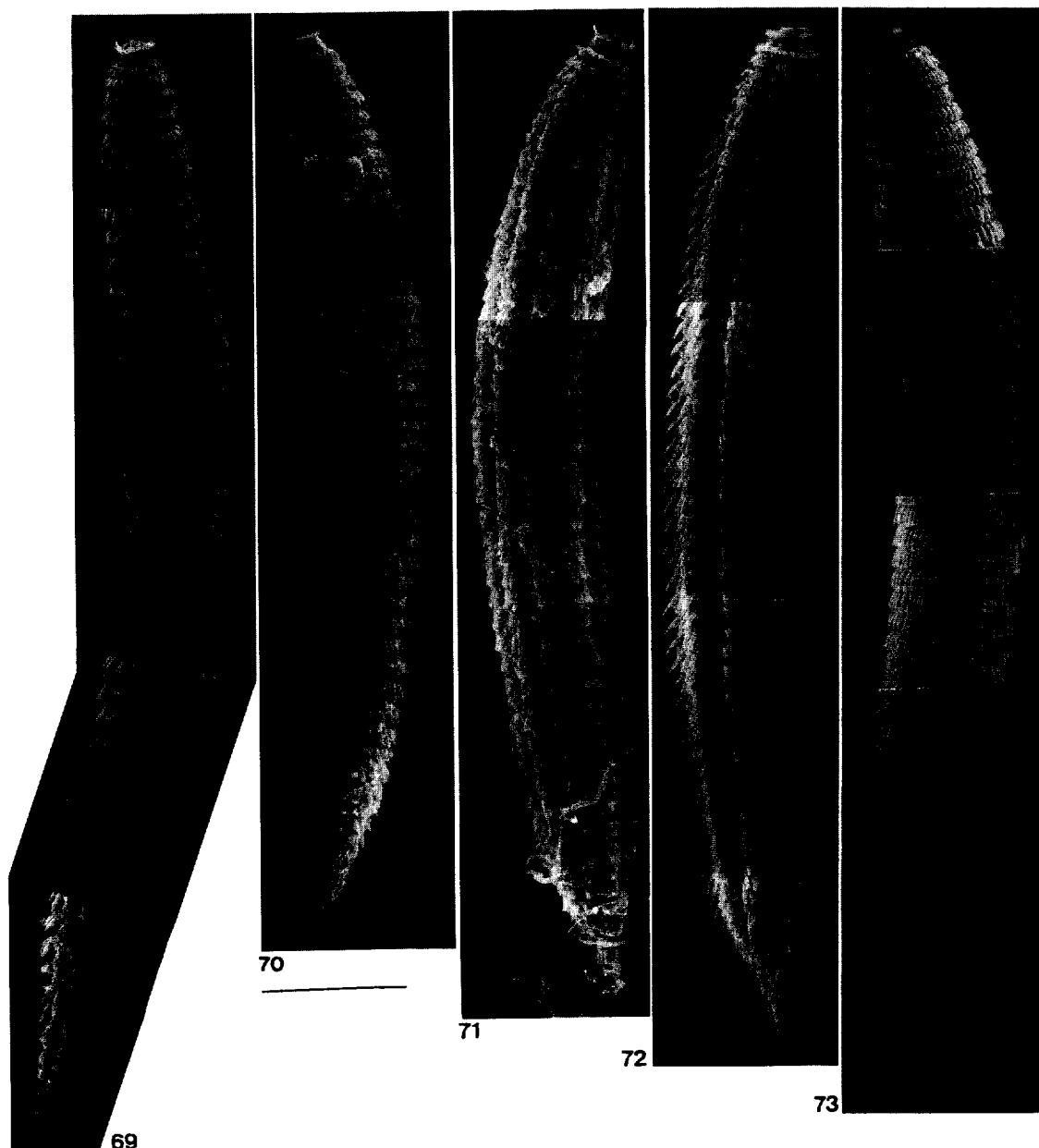
\* Figures indicate minimum and maximum values, and mean or mean± standard deviation in parentheses.  
(to be continued)

Table 26. (continued)

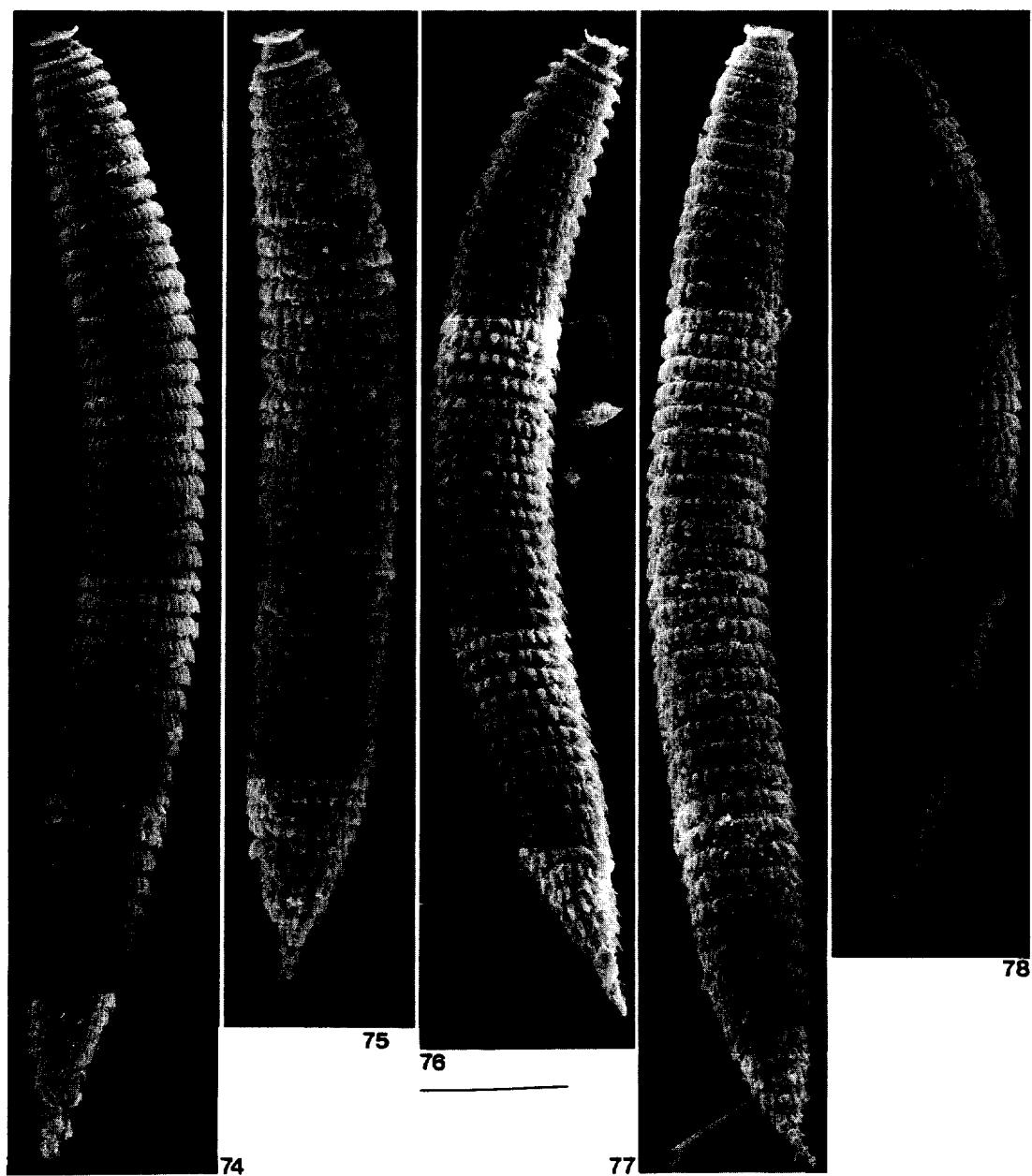
Character	Species and locality		
	<i>O. yambaruense</i> n. sp. Kunigami Okinawa	<i>O. abies</i> Mt. Eniwa Hokkaido	<i>O. segmentum</i> n. sp. Tsukuba Ibaraki
n	2 (Paratypes)	9	25 (Paratypes)
L ( $\mu\text{m}$ )	280-329 (305)	313-396 (371)	289-331 (306±11)
a	15.3-16.5 (15.9)	12.7-17.0 (15.1)	14.2-17.4 (15.7±0.8)
b	3.8-4.6 (4.2)	3.6-4.6 (4.2)	3.2-5.8 (4.2±0.5)
c	8.1-8.7 (8.4)	8.0-12.8 (9.3)	8.2-12.0 (9.2±0.9)
c'	2.5-2.6 (2.6)	1.7-2.8 (2.5)	1.9-3.1 (2.5±0.3)
R	108-112 (110.0)	125-132 (129.8)	120-129 (124.1±2.6)
Rex	38-44 (41.0)	40-49 (44.5)	43-53 (46.2±2.1)
Rhem	36-43 (39.5)	34-41 (38.6)	39-43 (41.1±1.3)
ROes	32-33 (32.5)	32-36 (34.0)	30-41 (36.0±3.0)
Ran	13-14 (13.5)	16-19 (17.6)	12-17 (14.1±1.4)
Ex. pore/L (%)	29.8-31.7 (30.8)	29.3-34.9 (32.0)	30.6-34.3 (32.5±1.0)
T (%)	38.7-43.5 (41.2)	33.5-54.2 (42.6)	36.2-54.6 (42.7±3.9)
Spicules ( $\mu\text{m}$ )	31.3-39.8 (35.6)	42.0-48.0 (45.6)	31.3-38.7 (33.6±2.0)
Gubernaculum ( $\mu\text{m}$ )	7.2-7.8 (7.5)	7.3-8.7 (7.8)	5.3-7.0 (6.2±0.4)

Table 26. (continued)

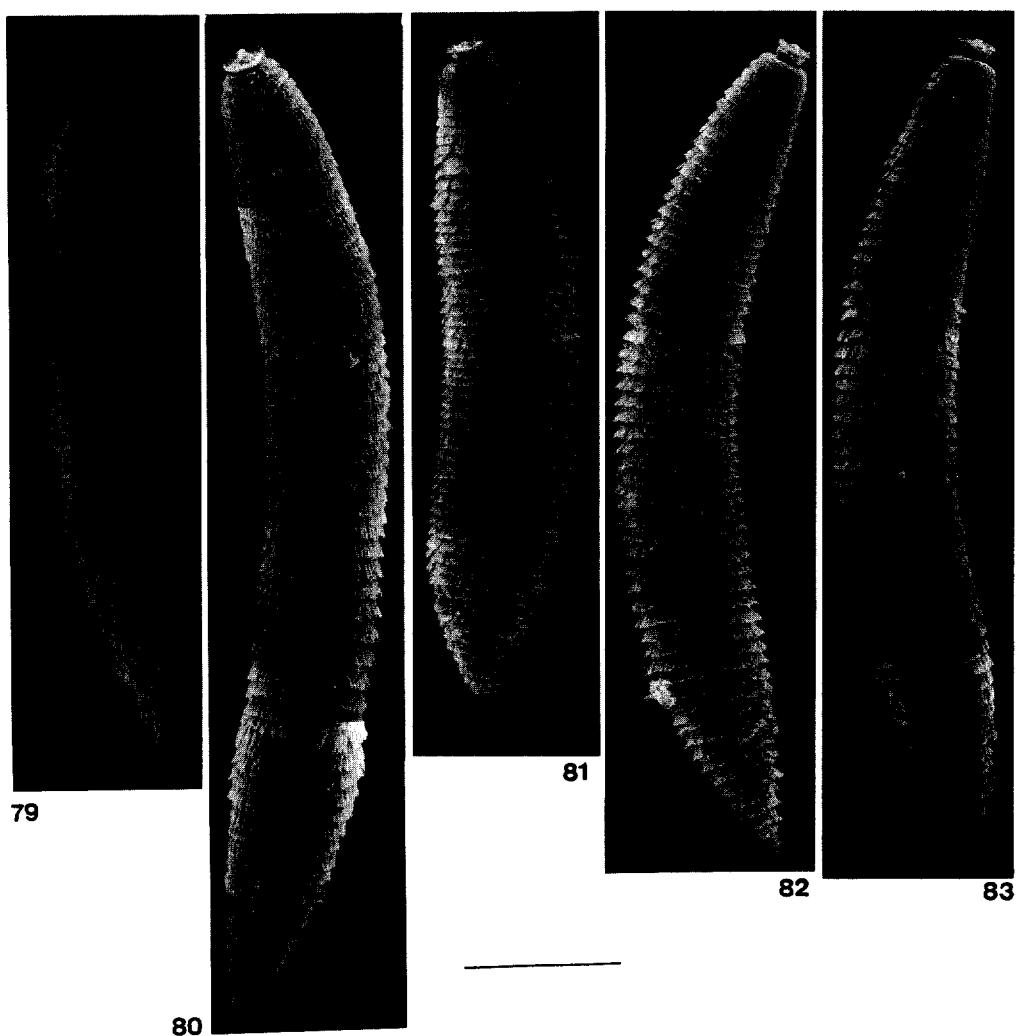
Character	Species and locality		
	<i>O. microdorum</i> n. sp. Mt. Sapporo Hokkaido		
n	1 (Paratype)		
L ( $\mu\text{m}$ )	346		
a	15.5		
b	4.1		
c	8.8		
c'	2.2		
R	137		
Rex	37		
Rhem	34		
ROes	36		
Ran	15		
Ex. pore/L (%)	26.0		
T (%)	36.8		
Spicules ( $\mu\text{m}$ )	38.5		
Gubernaculum ( $\mu\text{m}$ )	6.5		



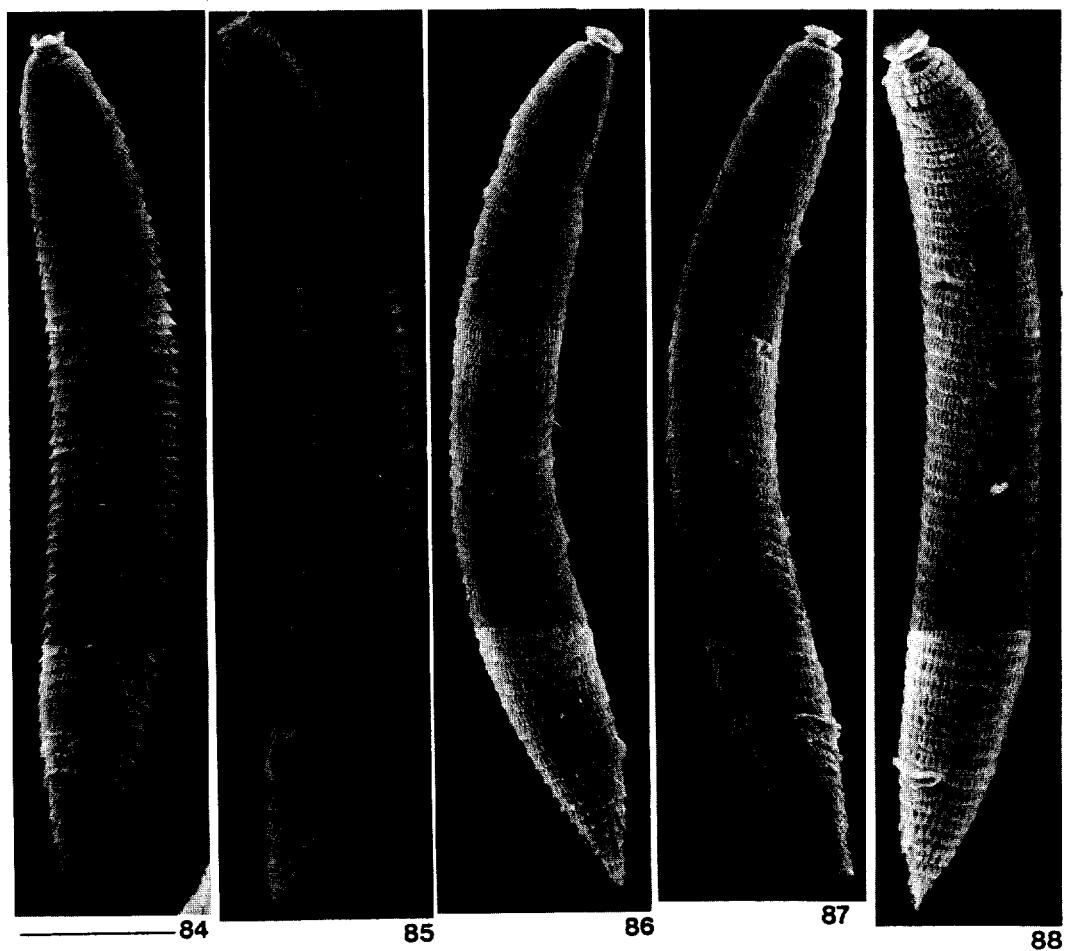
Figs. 69-73. *Ogma* spp., female adults: 69. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 70. *O. centone* (Mt. Eniwa, Hokkaido); 71. *O. octozonale* (Kotohira, Kagawa); 72. *Do.*, (Nishinasuno, Tochigi); 73. *O. altum* n.sp. (Mt. Norikura, Nagano). Scale bar indicates 50  $\mu\text{m}$ .



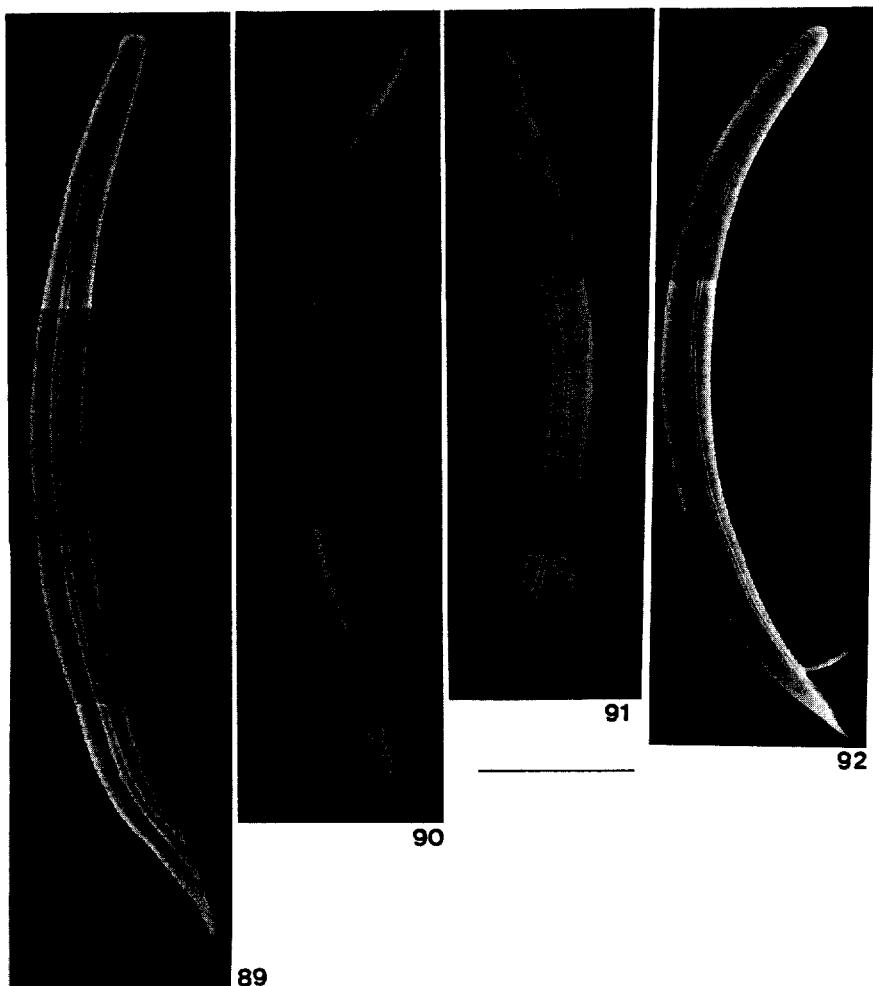
Figs. 74-78. *Ogma* spp., female adults: 74. *O. validum* n.sp. (Kunigami, Okinawa); 75. *O. dryum* (Mt. Aso, Kumamoto); 76. *Do.* (Mt. Norikura, Nagano); 77. *Do.* (Tsukuba, Ibaraki); 78. *Do.* (Sapporo, Hokkaido). Scale bar indicates 50  $\mu\text{m}$ .



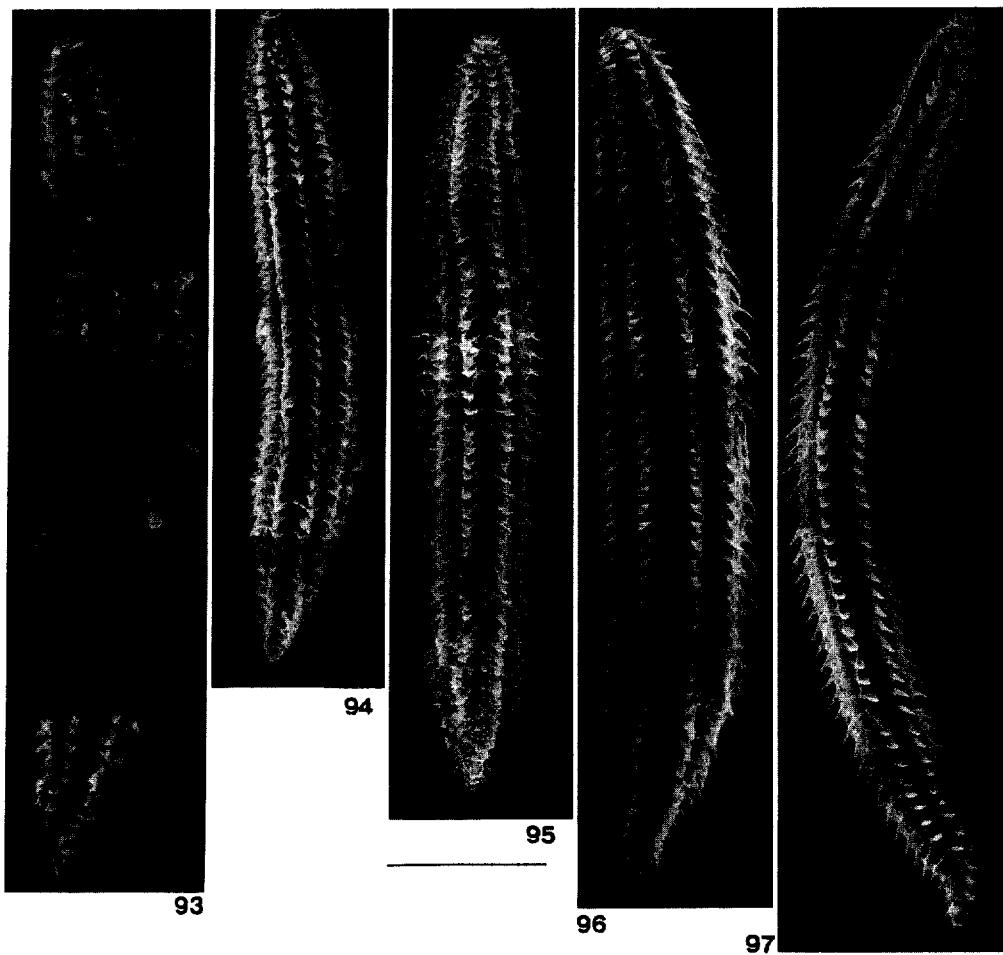
Figs. 79-83. *Ogma* spp., female adults: 79. *O. yambaruense* n.sp. (Kunigami, Okinawa); 80. *O. abies* (Mt. Eniwa, Hokkaido); 81. *O. segmentum* n.sp. (Mt. Aso, Kumamoto); 82. *Do.* (Misugi, Mie); 83. *Do.* (Mt. Norikura, Nagano). Scale bar indicates 50  $\mu\text{m}$ .



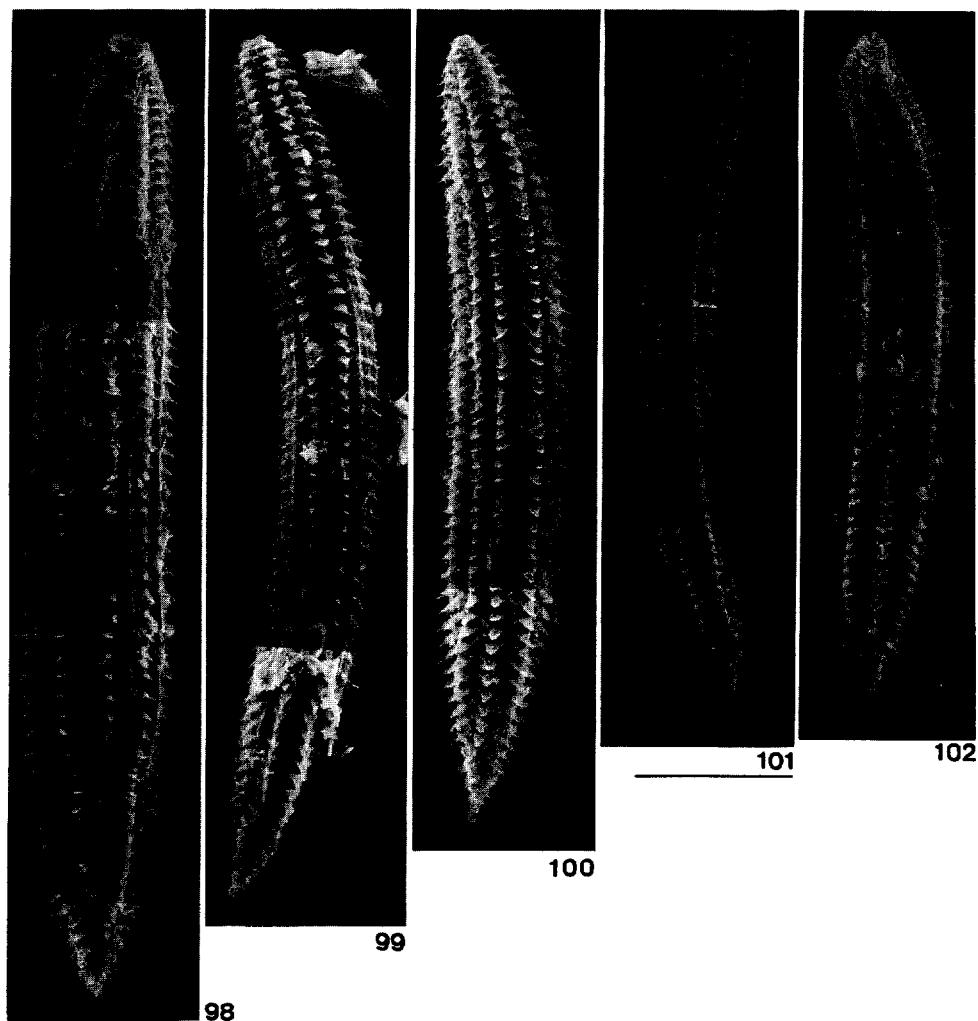
Figs. 84-88. *Ogma* spp., female adults: 84. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 85. *O. prini* n.sp. (Kunigami, Okinawa); 86. *Do.* (Fukuroi, Shizuoka); 87. *O. menzeli* (Mt. Eniwa, Hokkaido); 88. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Scale bar indicates 50  $\mu\text{m}$ .



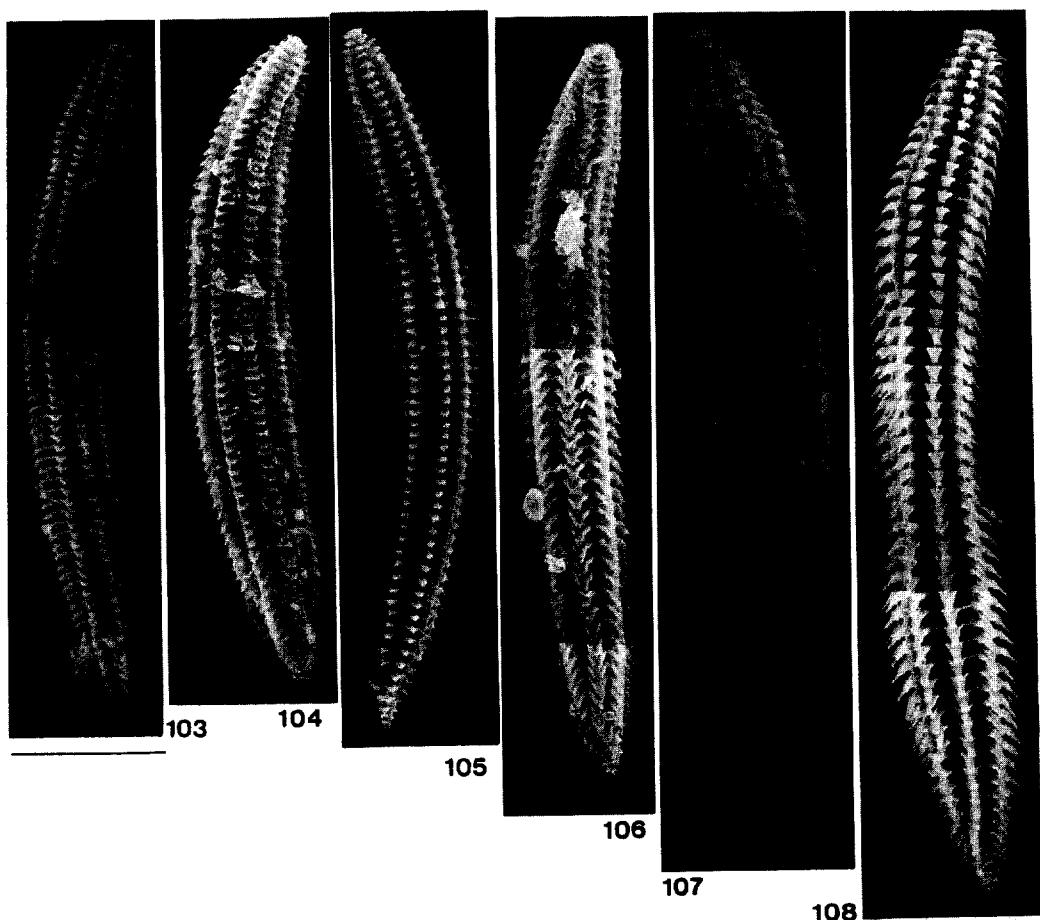
Figs. 89-92. *Ogma* spp., male adults: 89. *O. altum* n.sp. (Mt. Norikura, Nagano); 90. *O. dryum* (Nishigoshi, Kumamoto); 91. *O. segmentum* n.sp. (Mt. Meshimori, Nagano); 92. *O. abies* (Mt. Eniwa, Hokkaido). Scale bar indicates 50  $\mu$ m.



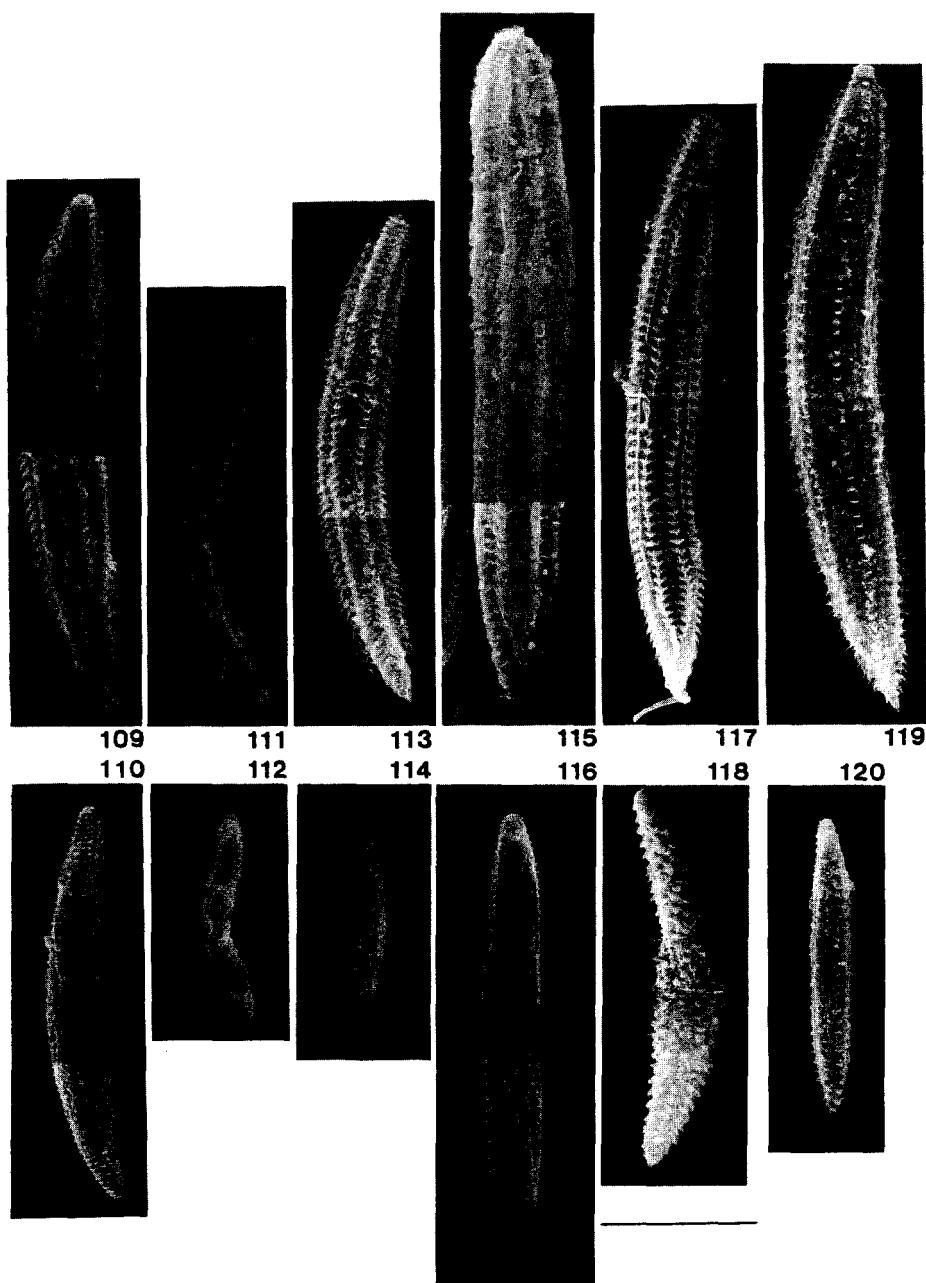
Figs. 93-97. *Ogma* spp., fourth-stage juveniles: 93. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 94. *O. centone* (Mt. Eniwa, Hokkaido); 95. *O. octozonale* (Nishinasuno, Tochigi); 96. *O. altum* n.sp., female (Mt. Norikura, Nagano); 97. *Do.*, male (*ditto*). Scale bar indicates 50  $\mu\text{m}$ .



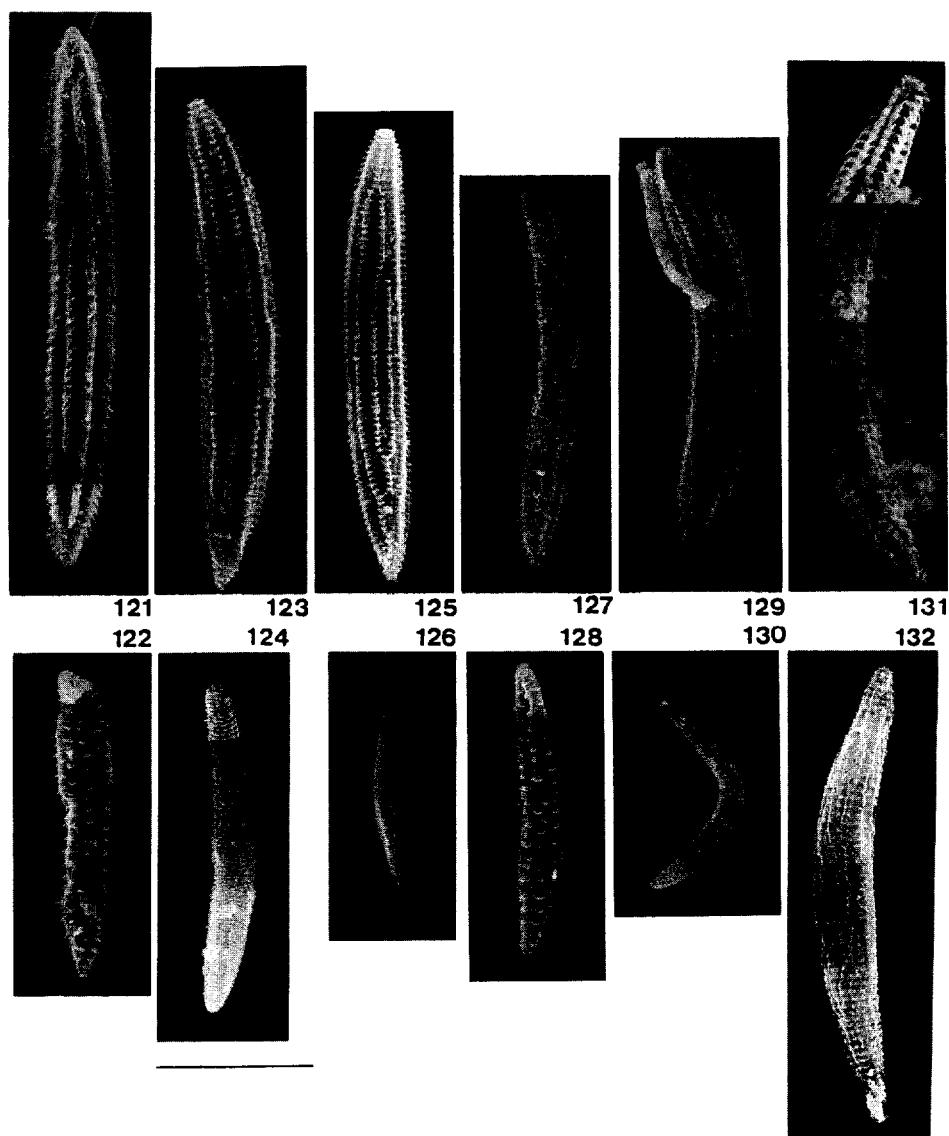
Figs. 98-102. *Ogma* spp., fourth-stage juveniles: 98. *O. validum* n.sp., female (Kunigami, Okinawa); 99. *Do.*, male (ditto); 100. *O. dryum*, female (Nishigoshi, Kumamoto); 101. *Do.*, male (ditto); 102. *O. yambaruense* n.sp. (Kunigami, Okinawa). Scale bar indicates 50  $\mu\text{m}$ .



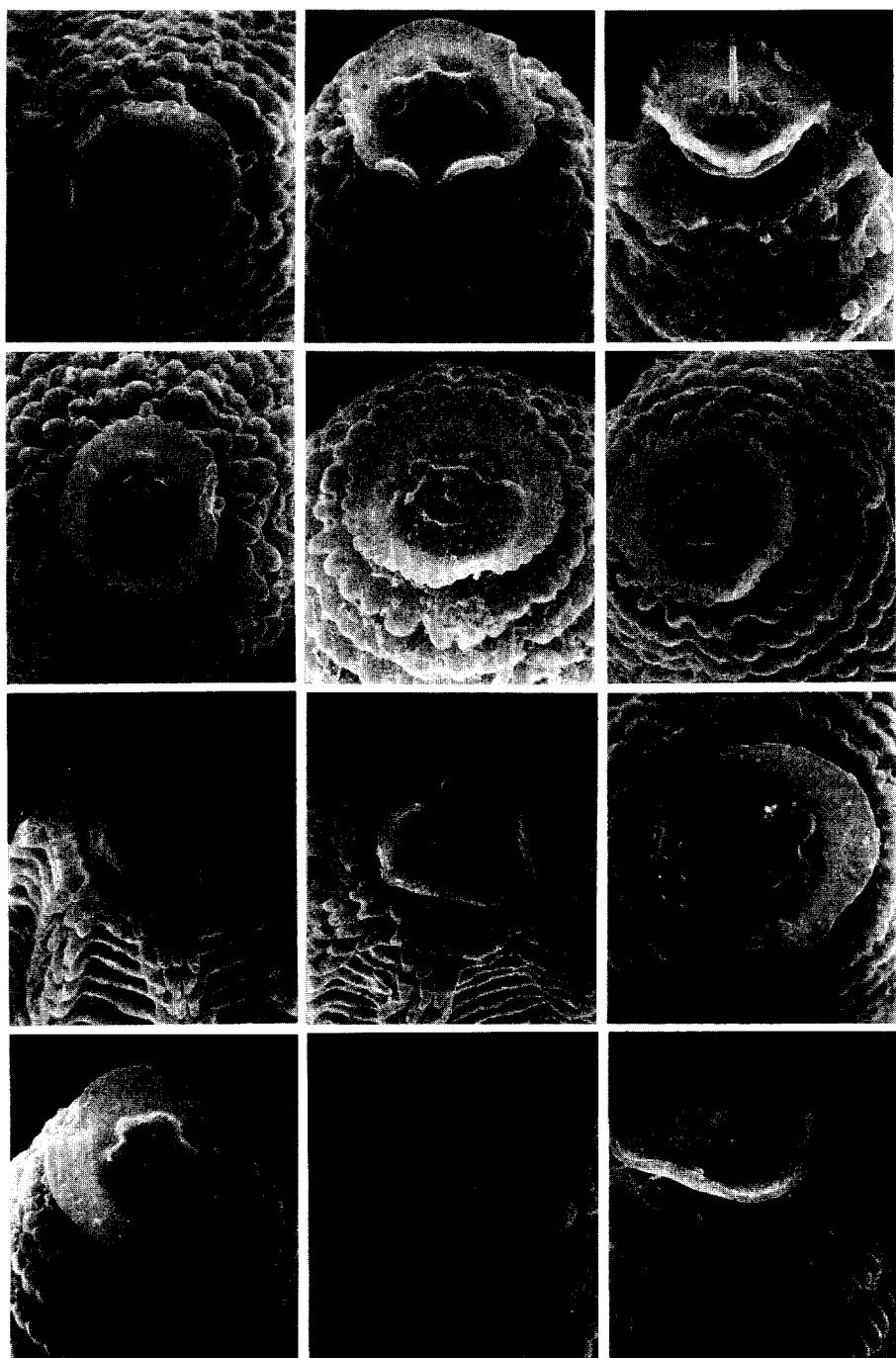
Figs. 103-108. *Ogma* spp., fourth-stage juveniles: 103. *O. abies* (Mt. Eniwa, Hokkaido); 104. *O. segmentum* n.sp., female (Tsukuba, Ibaraki); 105. *Do.*, male (*ditto*); 106. *O. primi* n.sp. (Kunigami, Okinawa); 107. *O. menzei* (Sapporo, Hokkaido); 108. *O. microdonum* n.sp. (Mt. Sapporo, Hokkaido). Scale bar indicates 50  $\mu\text{m}$ .



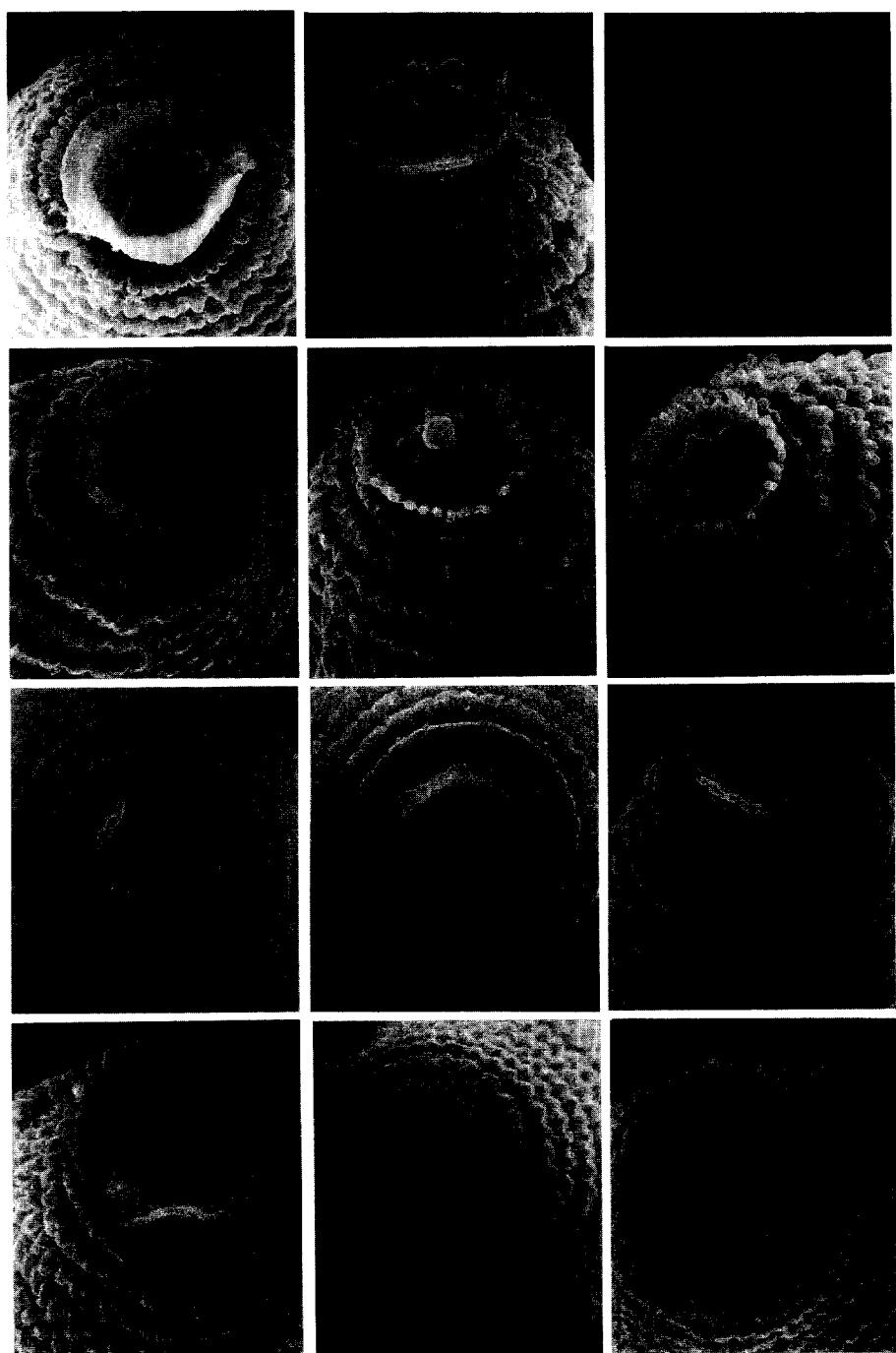
Figs. 109-120. *Ogma* spp., third- and second-stage juveniles: 109. *O. nemorosum* n.sp. (Mt. Norikura, Nagano): third stage; 110. *Do.*, second stage; 111. *O. centone* (Mt. Eniwa, Hokkaido): third stage; 112. *Do.*, second stage; 113. *O. octozonale* (Nishinasuno, Tochigi): third stage; 114. *Do.*, second stage; 115. *O. altum* n.sp. (Mt. Norikura, Nagano): third stage; 116. *Do.*, second stage; 117. *O. validum* n.sp. (Kunigami, Okinawa): third stage; 118. *Do.*, second stage; 119. *O. dryum* (Nishigoshi, Kumamoto): third stage; 120. *Do.*, second stage. Scale bar indicates 50  $\mu$ m.



Figs. 121-132. *Ogma* spp., third- and second stage juveniles: 121. *O. yambaruense* n.sp. (Kunigami, Okinawa): third stage; 122. *Do.*, second stage; 123. *O. abies* (Mt. Eniwa, Hokkaido): third stage; 124. *Do.*, second stage; 125. *O. segmentum* n.sp. (Tsukuba, Ibaraki): third stage; 126. *Do.*, second stage; 127. *O. prini* n.sp. (Kunigami, Okinawa): third stage; 128. *Do.*, second stage; 129. *O. menzeli* (Mt. Eniwa, Hokkaido): third stage; 130. *Do.*, second stage; 131. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido): third stage; 132. *Do.*, second stage. Scale bar indicates 50  $\mu\text{m}$ .

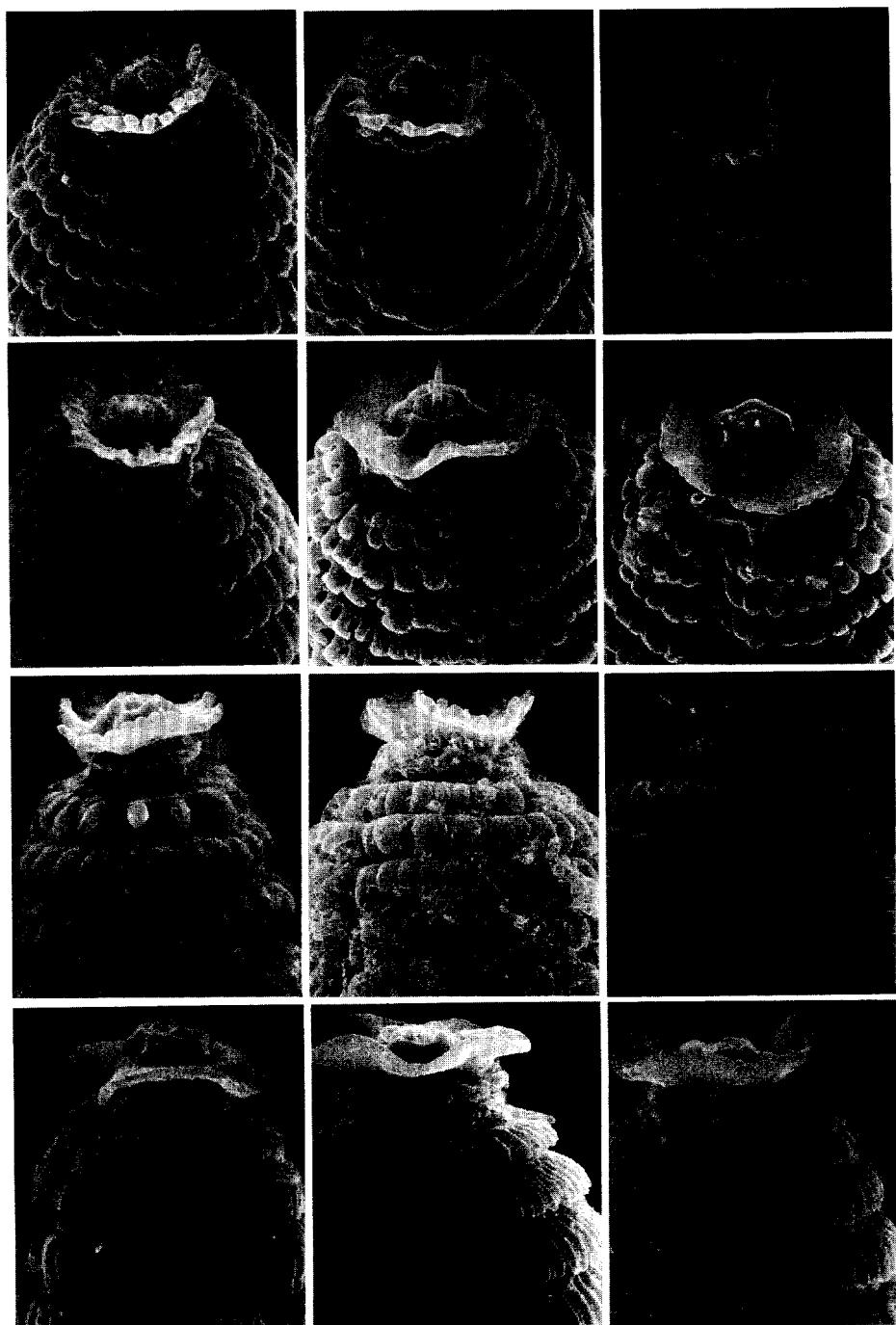


Figs. 133-144. *Ogma* spp., female adults, face views: 133-135. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 136-138. *O. centone* (Mt. Eniwa, Hokkaido); 139-140. *O. octozonale* (Nishinasuno, Tochigi); 141-142. *O. altum* n.sp. (Mt. Norikura, Nagano); 143-144. *O. validum* n.sp. (Kunigami, Okinawa). Scale bar indicates 5  $\mu$ m.



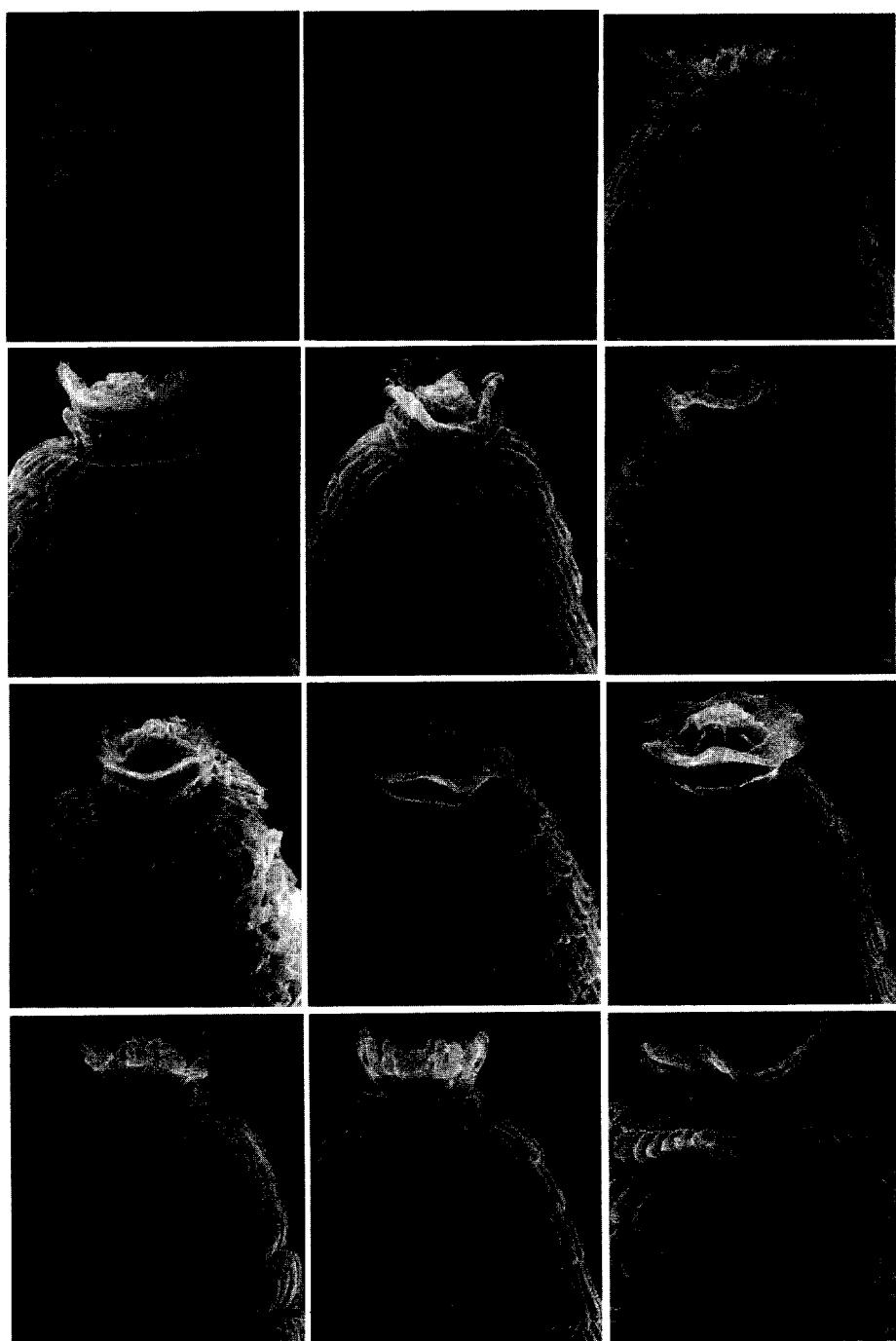
145	146	147
148	149	150
151	152	153
154	155	156

Figs. 145-156. *Ogma* spp., female adults, face views: 145. *O. dryum* (Nishigoshi, Kumamoto); 146. *Do.* (Kusatsu, Gunma); 147. *Do.* (Sapporo, Hokkaido); 148. *O. yambaruense* n.sp. (Kunigami, Okinawa); 149. *O. abies* (Shibu Pass, Gunma-Nagano); 150. *Do.* (Mt. Eniwa, Hokkaido); 151. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 152. *Do.* (Nishinasuno, Tochigi); 153. *Do.* (Mt. Aso, Kumamoto); 154-155. *O. prini* n.sp. (Kunigami, Okinawa); 156. *Do.* (Fukuroi, Shizuoka). Scale bar indicates 5  $\mu\text{m}$ .



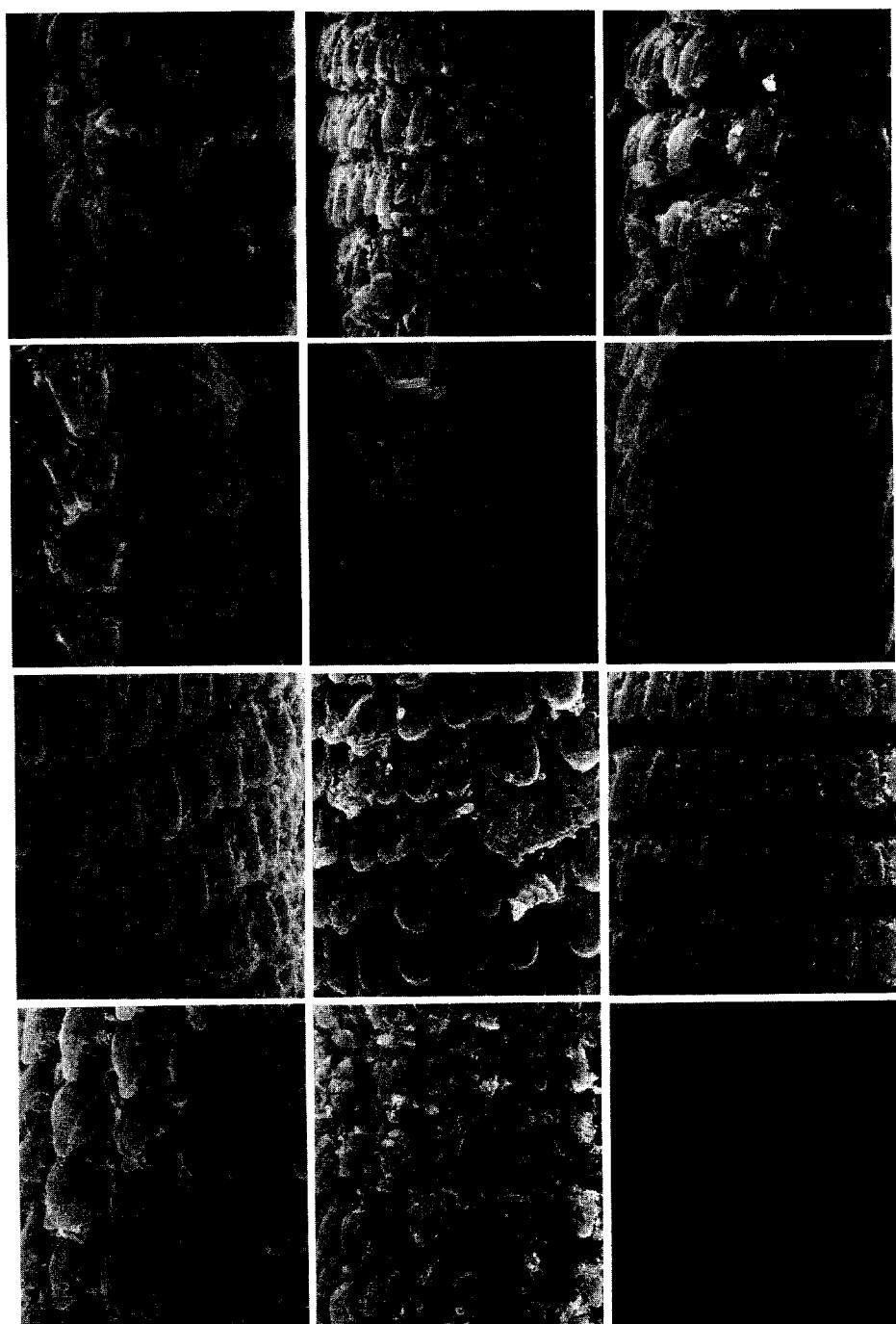
Figs. 157-168. *Ogma* spp., female adults. Face views: 157-160. *O. menzeli* (Sapporo, Hokkaido); 161-162. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Heads: 163. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 164. *O. centone* (Mt. Eniwa, Hokkaido); 165. *O. octozonale* (Nishinasuno, Tochigi); 166. *O. altum* n.sp. (Mt. Norikura, Nagano); 167. *O. validum* n.sp. (Kunigami, Okinawa); 168. *O. dryum* (Nishigoshi, Kumamoto).

Scale bar indicates 5  $\mu\text{m}$ .

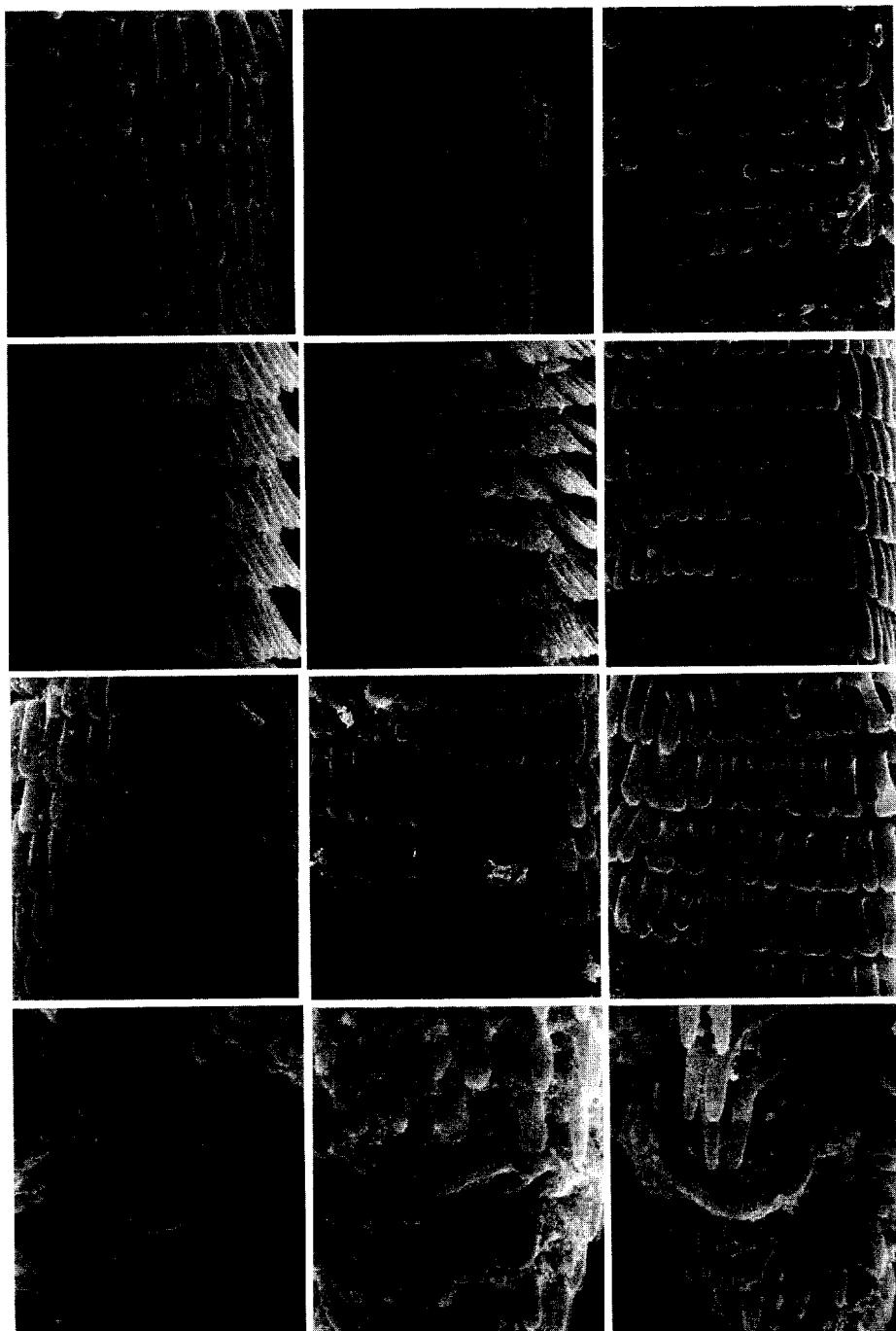


169	170	171
172	173	174
175	176	177
178	179	180

Figs. 169-180. *Ogma* spp., female adults, heads: 169. *O. yambaruense* n.sp. (Kunigami, Okinawa); 170. *O. abies* (Shibu Pass, Gunma-Nagano); 171. *Do.* (Mt. Eniwa, Hokkaido); 172. *O. segmentum* n.sp. (Nishinasuno, Tochigi); 173. *Do.* (Mt. Meshimori, Nagano); 174. *Do.* (Tsukuba, Ibaraki); 175. *Do.* (Mt. Norikura, Nagano); 176. *O. prini* n.sp. (Kunigami, Okinawa); 177. *Do.* (Fukuroi, Shizuoka); 178-179. *O. menzeli* (Sapporo, Hokkaido); 180. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Scale bar indicates 5  $\mu\text{m}$ .

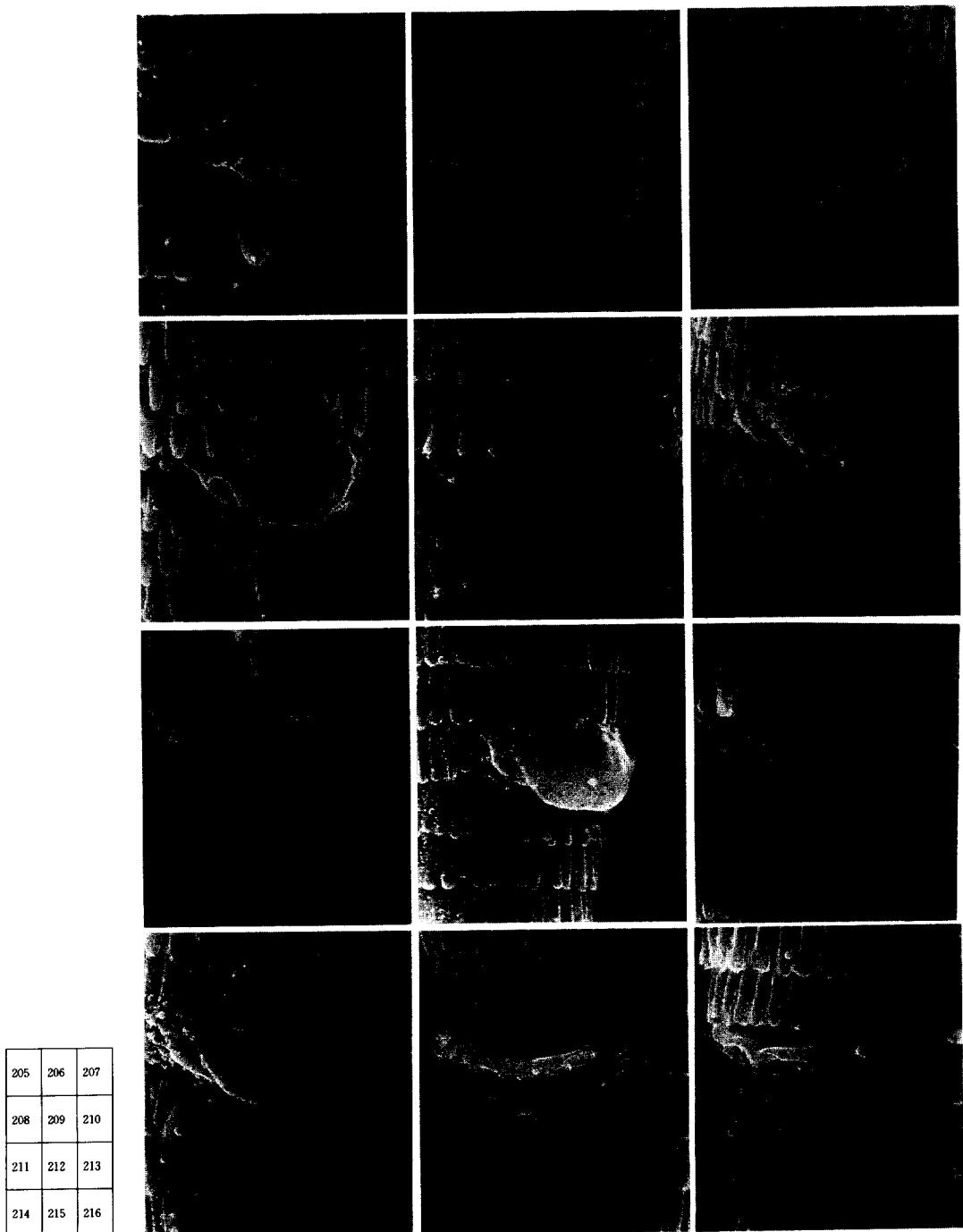


Figs. 181-192. *Ogma* spp., female adults, body scales: 181. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 182-183. *O. centone* (Mt. Eniwa, Hokkaido); 184-186. *O. octozonale* (Nishinasuno, Tochigi); 187-188. *O. altum* n.sp. (Mt. Norikura, Nagano); 189. *O. validum* n.sp. (Kunigami, Okinawa); 190. *O. dryum* (Mt. Aso, Kumamoto); 191. *Do.* (Mt. Norikura, Nagano); 192. *Do.* (Sapporo, Hokkaido). Scale bar indicates 5  $\mu\text{m}$ .

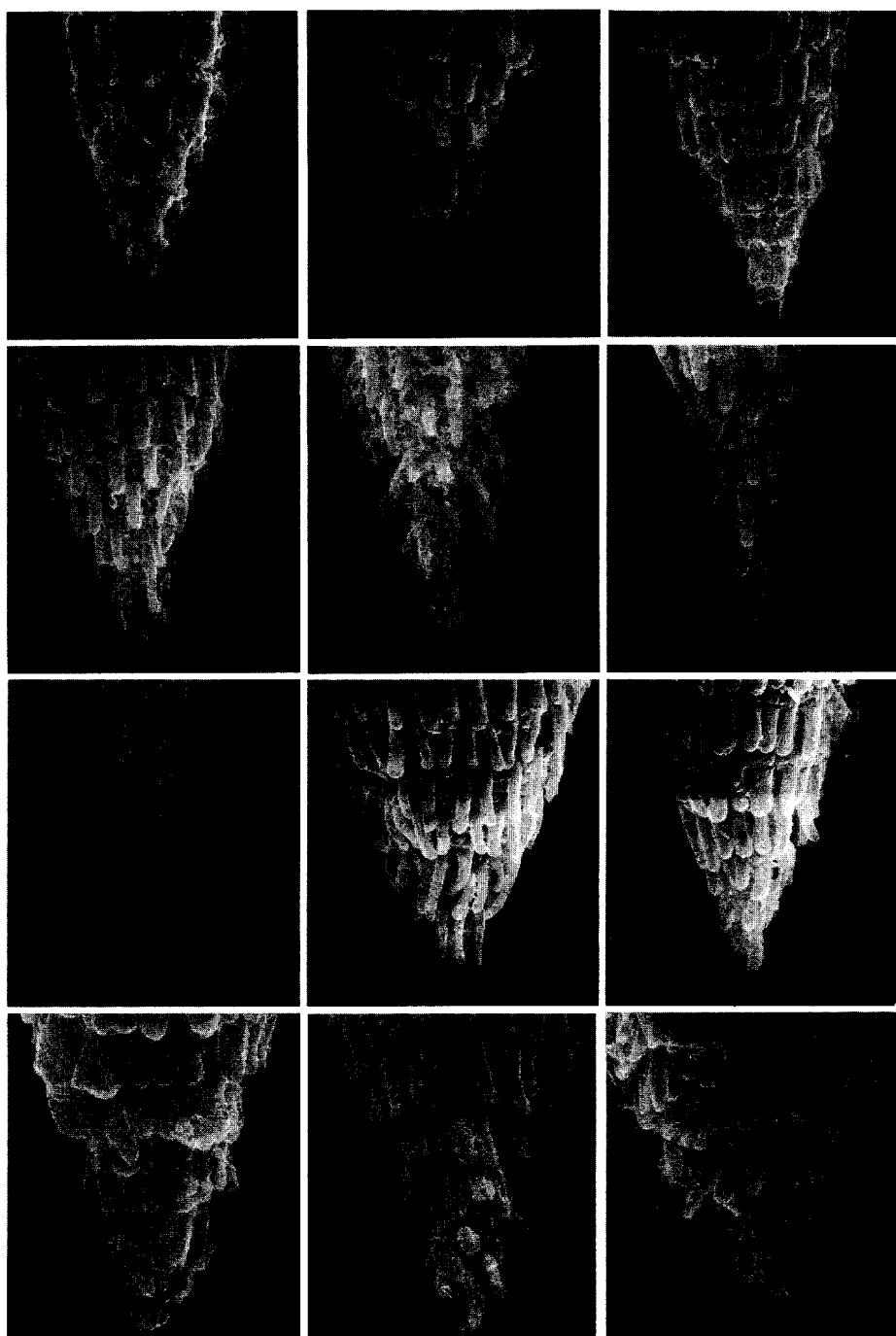


193	194	195
196	197	198
199	200	201
202	203	204

Figs. 193-204. *Ogma* spp., female adults, body scales: 193. *O. yambaruense* n.sp. (Kunigami, Okinawa); 194. *O. abies* (Shibu Pass, Gunma-Nagano); 195. *Do.* (Mt. Eniwa, Hokkaido); 196. *O. segmentum* n. sp. (Tsukuba, Ibaraki); 197. *Do.* (Mt. Aso, Kumamoto); 192. *O. prini* n.sp. (Fukuroi, Shizuoka); 199-200. *O. menzeli* (Sapporo, Hokkaido); 201. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Vulval lips: 202. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 203. *O. centone* (Mt. Eniwa, Hokkaido); 204. *O. octozonale* (Nishi-nasuno, Tochigi). Scale bar indicates 5  $\mu\text{m}$ .

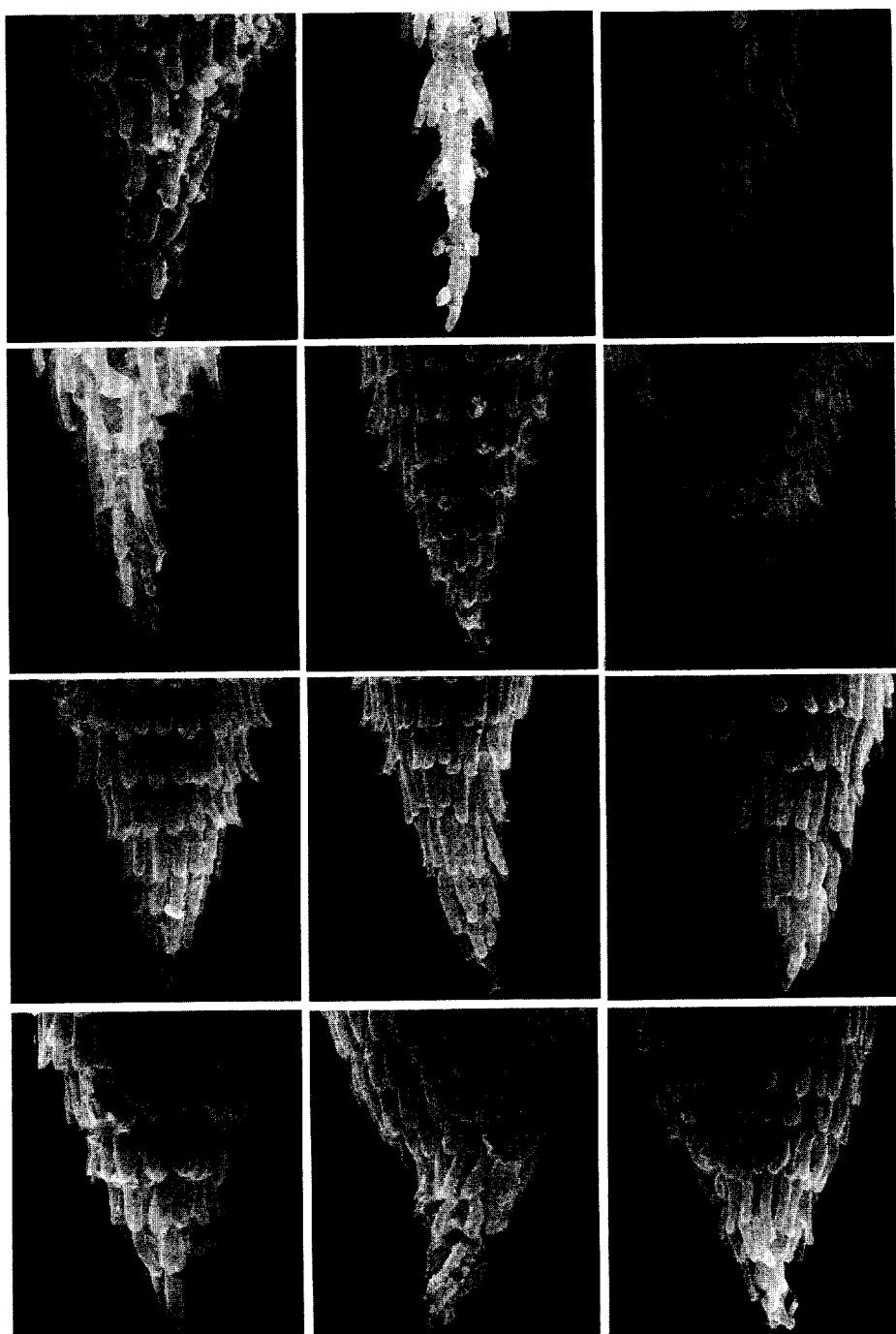


Figs. 205-216. *Ogma* spp., female adults, vulval lips: 205. *O. altum* n.sp. (Mt. Norikura, Nagano); 206. *O. validum* n.sp. (Kunigami, Okinawa); 207. *O. dryum* (Tsukuba, Ibaraki); 208. *O. yambaruense* n.sp. (Kunigami, Okinawa); 209. *O. abies* (Mt. Eniwa, Hokkaido); 210. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 211. *Do.* (Mt. Norikura, Nagano); 212. *O. prini* n.sp. (Kunigami, Okinawa); 213. *Do.* (Fukuroi, Shizuoka); 214. *O. menzeli* (Sapporo, Hokkaido); 215-216. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Scale bar indicates 5  $\mu\text{m}$ .

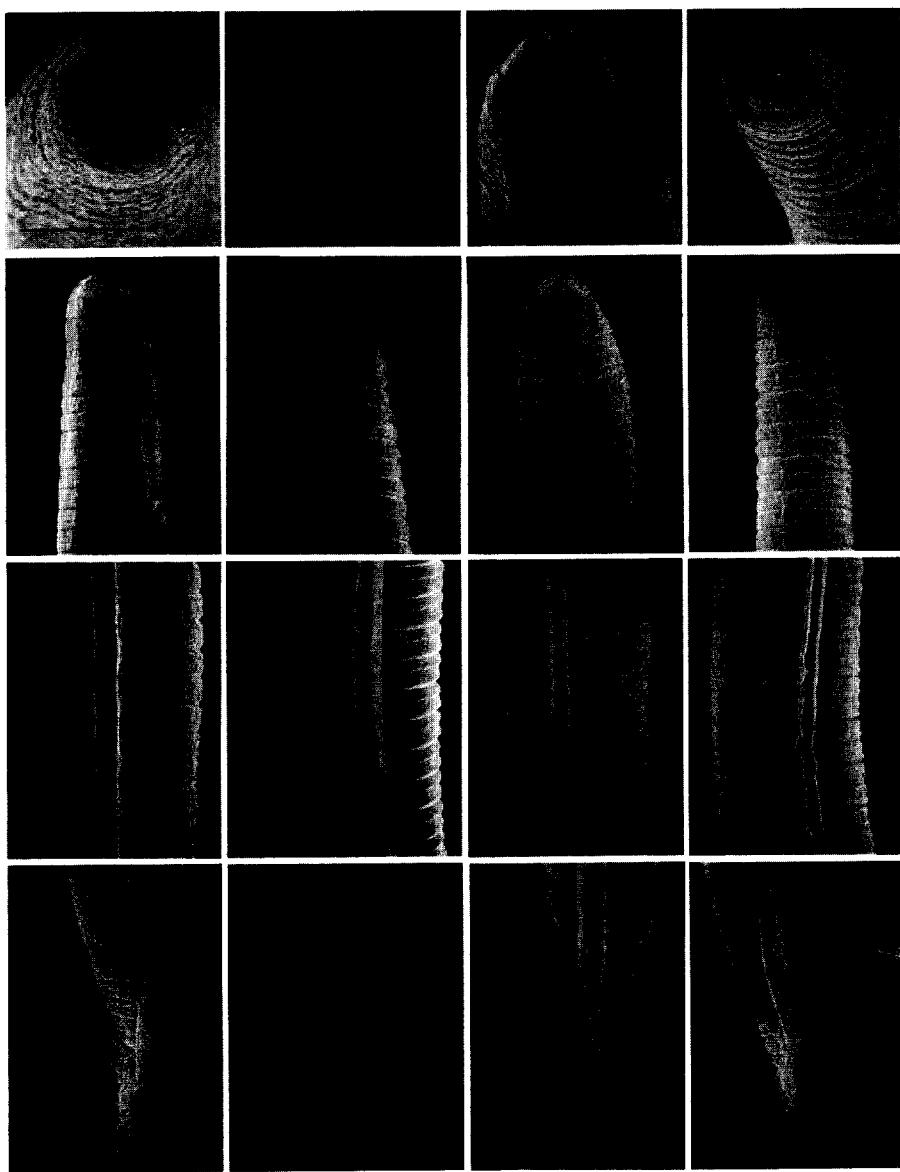


217	218	219
220	221	222
223	224	225
226	227	228

Figs. 217-228. *Ogma* spp., female adults, tails: 217-218. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 219-220. *O. cenate* (Mt. Eniwa, Hokkaido); 221. *O. octozonale* (Mt. Aso, Kumamoto); 222. *Do.* (Nishinasuno, Tochigi); 223. *Do.* (Nishisenboku, Akita); 224-226. *O. altum* n.sp. (Mt. Norikura, Nagano); 227-228. *O. validum* n.sp. (Kunigami, Okinawa). Scale bar indicates 5  $\mu\text{m}$ .

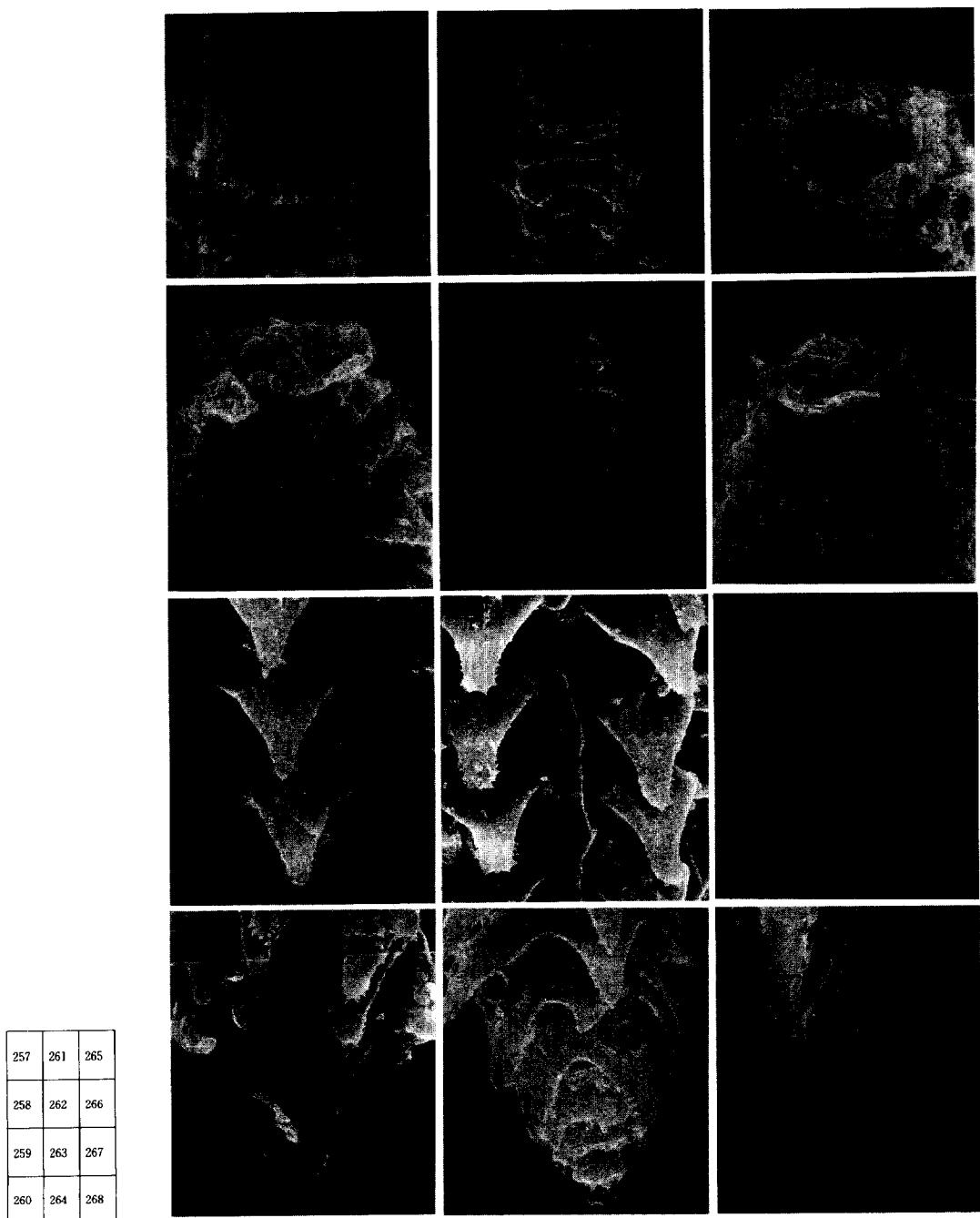


Figs. 229-240. *Ogma* spp., female adults, tails: 229. *O. dryum* (Tsukuba, Ibaraki); 230. *Do.* (Mt. Norikura, Nagano); 231. *Do.* (Sapporo, Hokkaido); 232. *O. yambaruense* n.sp. (Kunigami, Okinawa); 233. *O. abies* (Mt. Eniwa, Hokkaido); 234. *O. segmentum* n.sp. (Mt. Aso, Kumamoto); 235. *Do.* (Tsukuba, Ibaraki); 236-237. *O. prini* n.sp. (Fukuroi, Shizuoka); 238. *O. menzeli* (Sapporo, Hokkaido); 239-240. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido). Scale bar indicates 5  $\mu\text{m}$ .

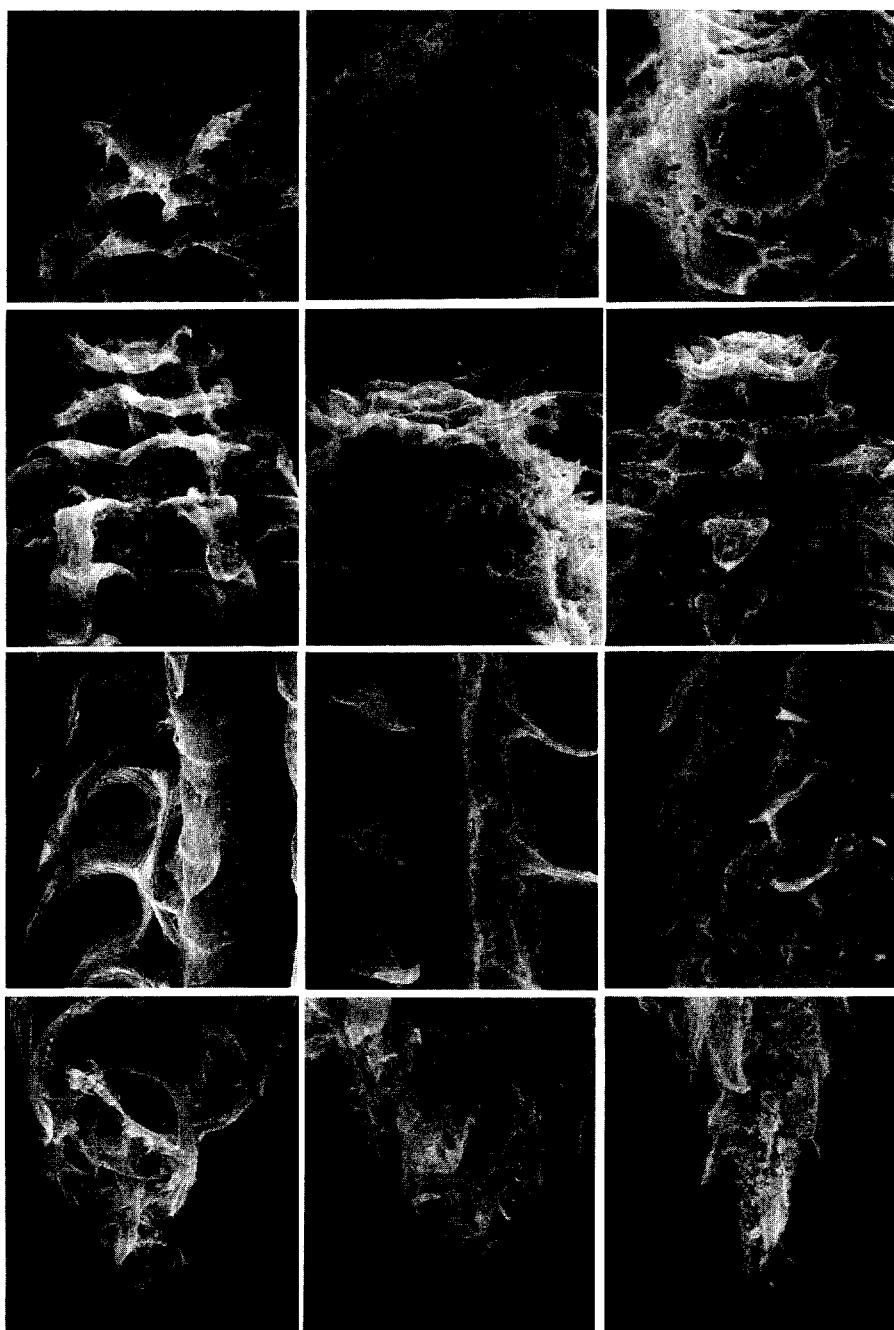


241	245	249	253
242	246	250	254
243	247	251	255
244	248	252	256

Figs. 241-256. *Ogma* spp., male adults. *O. altum* n.sp. (Mt. Norikura, Nagano); 241. Face view, 246. Head, 247. Lateral field, 248. Tail. *O. abies* (Mt. Eniwa, Hokkaido); 249. Face view, 250. Head, 251. Lateral field, 252. Tail. *O. segmentum* n.sp. (Mt. Meshimori, Nagano); 253. Face view, 254. Head, 255. Lateral field, 256. Tail. Scale bar indicates 3  $\mu\text{m}$  for face views and 5  $\mu\text{m}$  for others.

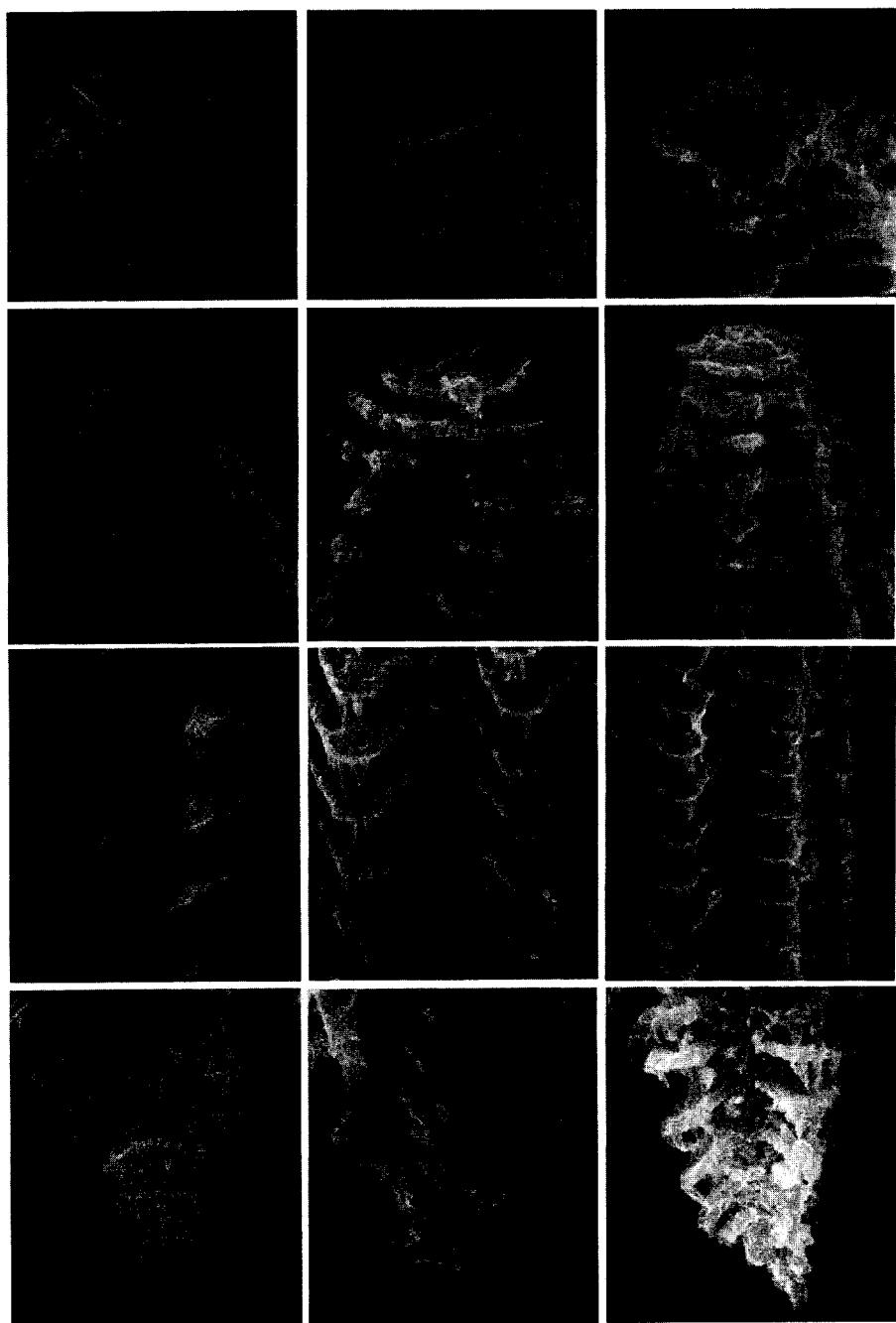


Figs. 257-268. *Ogma* spp., fourth-stage juveniles (females). *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 257. Face view, 258. Head, 259. Body scales, 260. Tail. *O. centone* (Mt. Eniwa, Hokkaido); 261. Face view, 262. Head, 263. Body scales, 264. Tail. *O. octozonale* (Nishinasuno, Tochigi); 265. Face view, 266. Head, 267. Body scales, 268. Tail. Scale bar indicates 3  $\mu$ m.



269	273	277
270	274	278
271	275	279
272	276	280

Figs. 269-280. *Ogma* spp., fourth-stage juveniles (females). *O. altum* n.sp. (Mt. Norikura, Nagano); 269. Face view, 270. Head. 271. Body scales, 272. Tail. *O. validum* n.sp. (Kunigami, Okinawa); 273. Face view, 274. Head, 275. Body scales, 276. Tail. *O. dryum* (Nishigoshi, Kumamoto); 277. Face view, 278. Head, 279. Body scales, 280. Tail. Scale bar indicates 3  $\mu\text{m}$ .

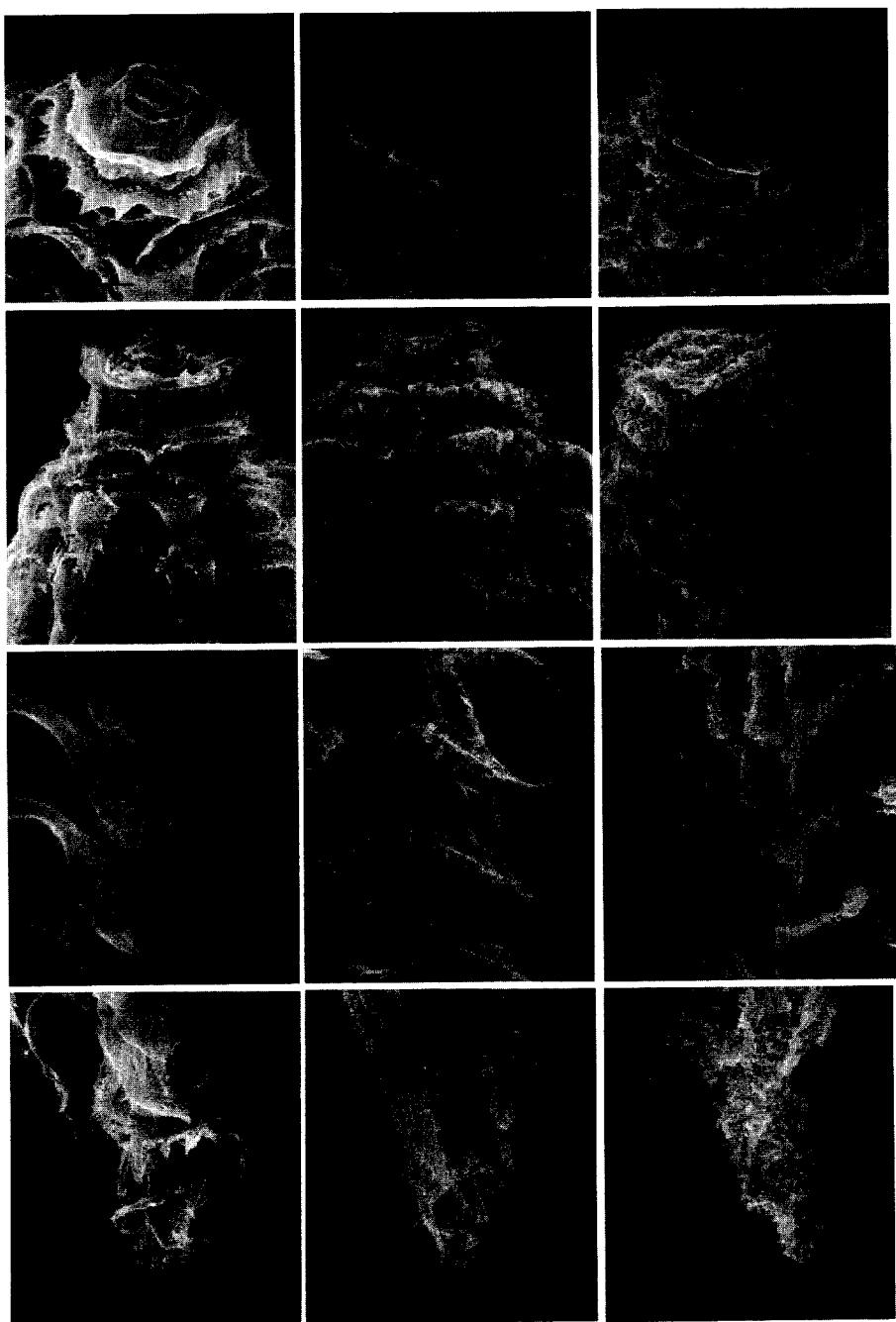


Figs. 281-292. *Ogmia* spp., fourth-stage juveniles (females). *O. yambaruense* n.sp. (Kunigami, Okinawa); 281. Face view, 282. Head, 283. Body scales, 284. Tail. *O. abies* (Mt. Eniwa, Hokkaido); 285. Face view, 286. Head, 287. Body scales, 288. Tail. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 289. Face view, 290. Head, 291. Body scales, 292. Tail. Scale bar indicates 3  $\mu$ m.

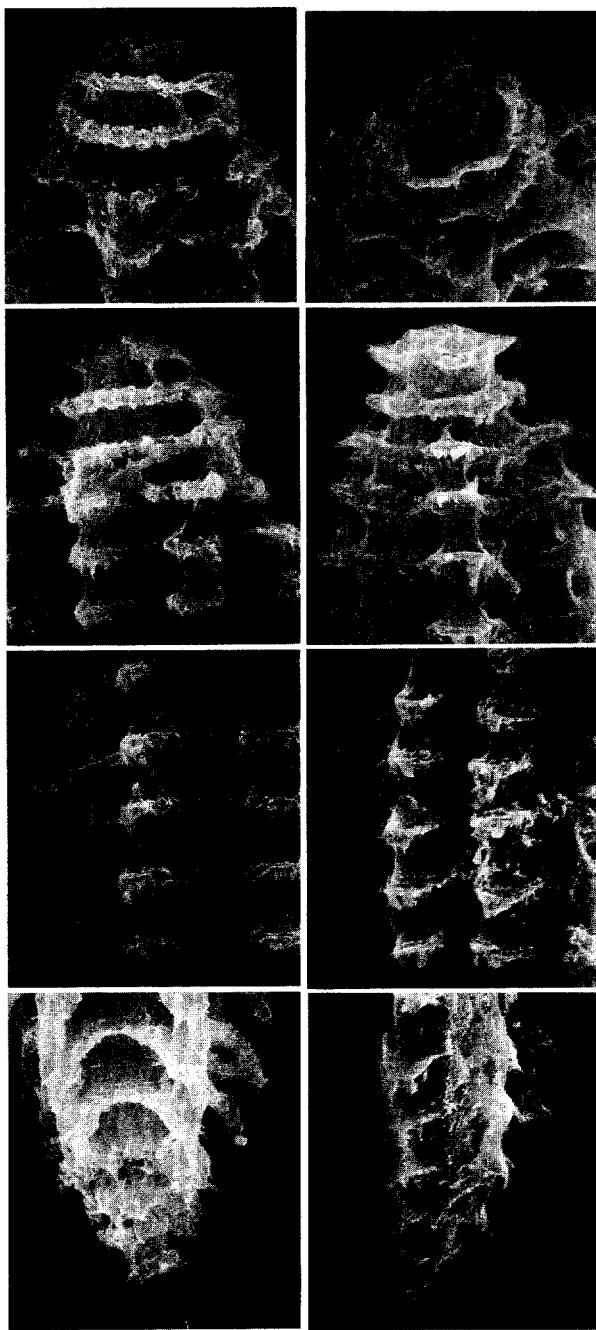


293	297	301
294	298	302
295	299	303
296	300	304

Figs. 293-304. *Ogma* spp., fourth-stage juveniles (females). *O. prini* n.sp. (Kunigami, Okinawa); 293. Face view, 294. Head, 295. Body scales, 296. Tail. *O. menzeli* (Sapporo, Hokkaido); 297. Face view, 298. Head, 299. Body scales, 300. Tail. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido); 301. Face view, 302. Head, 303. Body scales, 304. Tail. Scale bar indicates 3  $\mu\text{m}$ .

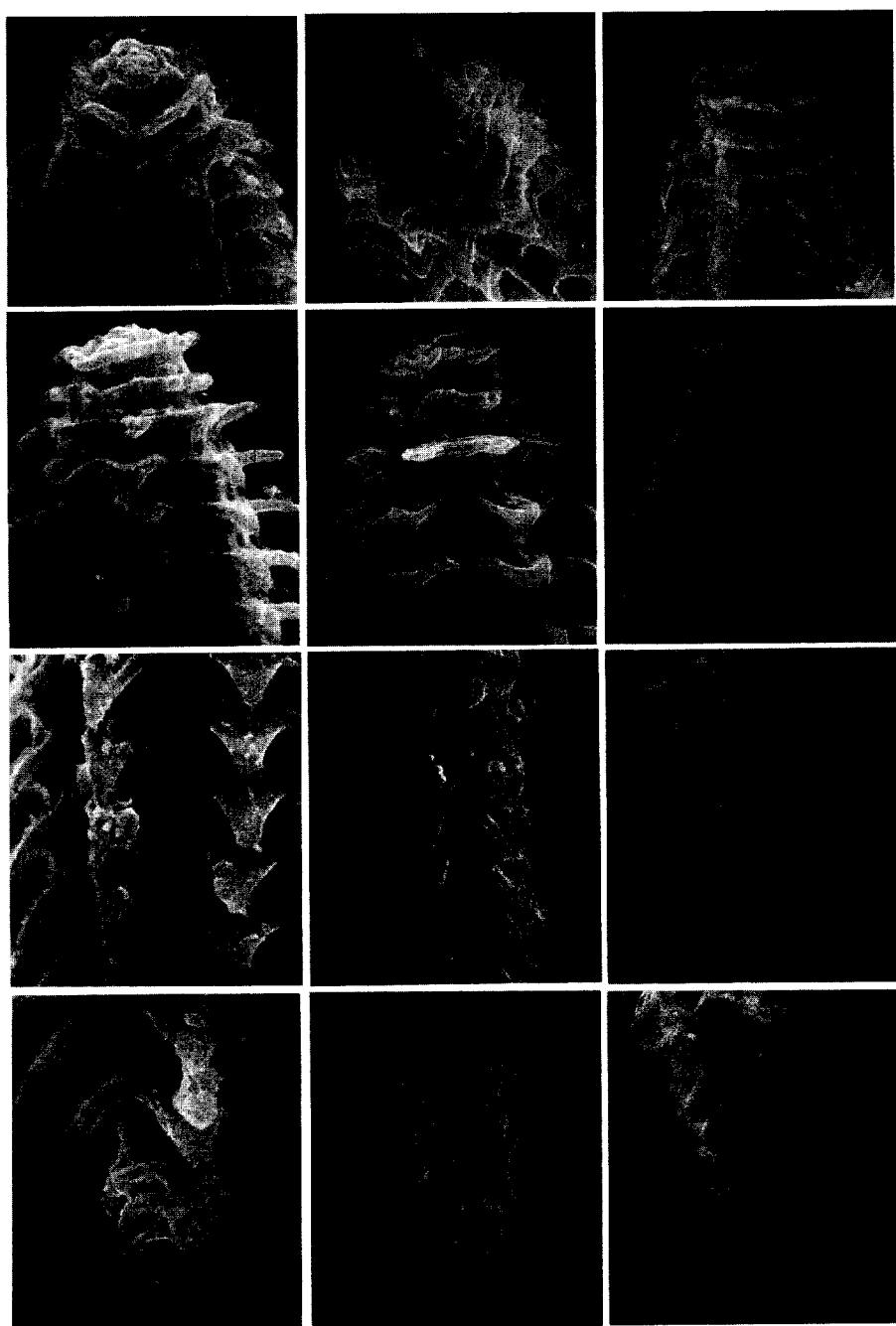


Figs. 305-316. *Oigma* spp., fourth-stage juveniles (males). *O. altum* n.sp. (Mt. Norikura, Nagano); 305. Face view, 306. Head. 307. Body scales, 308. Tail. *O. validum* n.sp. (Kunigami, Okinawa); 309. Face view, 310. Head, 311. Body scales, 312. Tail. *O. dryum* (Nishigoshi, Kumamoto); 313. Face view, 314. Head, 315. Body scales, 316. Tail. Scale bar indicates 33  $\mu$ m.

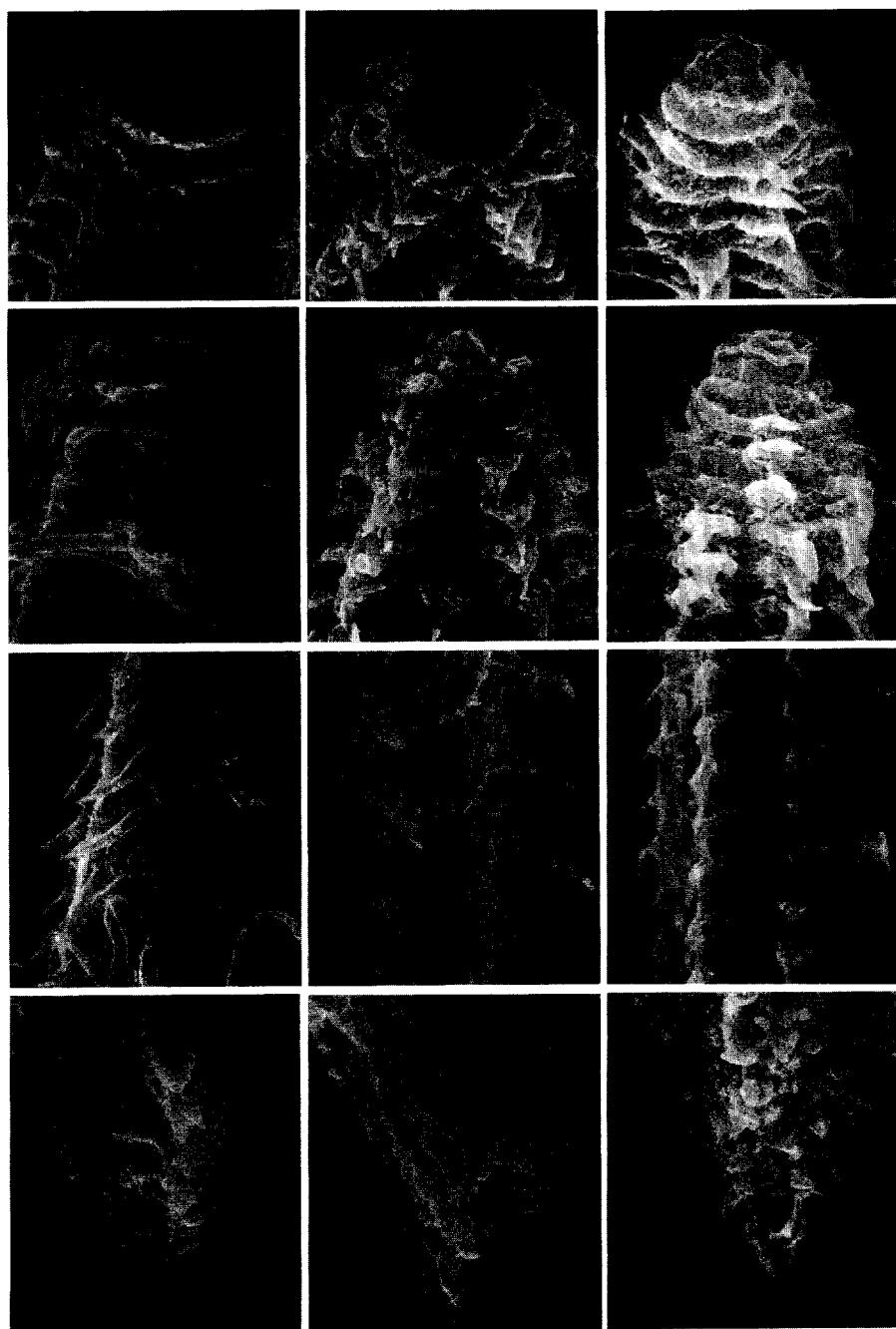


317	321
318	322
319	323
320	324

Figs. 317-324. *Ogma* spp., fourth-stage juveniles (males). *O. abies* (Mt. Eniwa, Hokkaido); 317. Face view, 318. Head, 319. Body scales, 320. Tail. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 321. Face view, 322. Head, 323. Body scales, 324. Tail. Scale bar indicates 3  $\mu\text{m}$ .

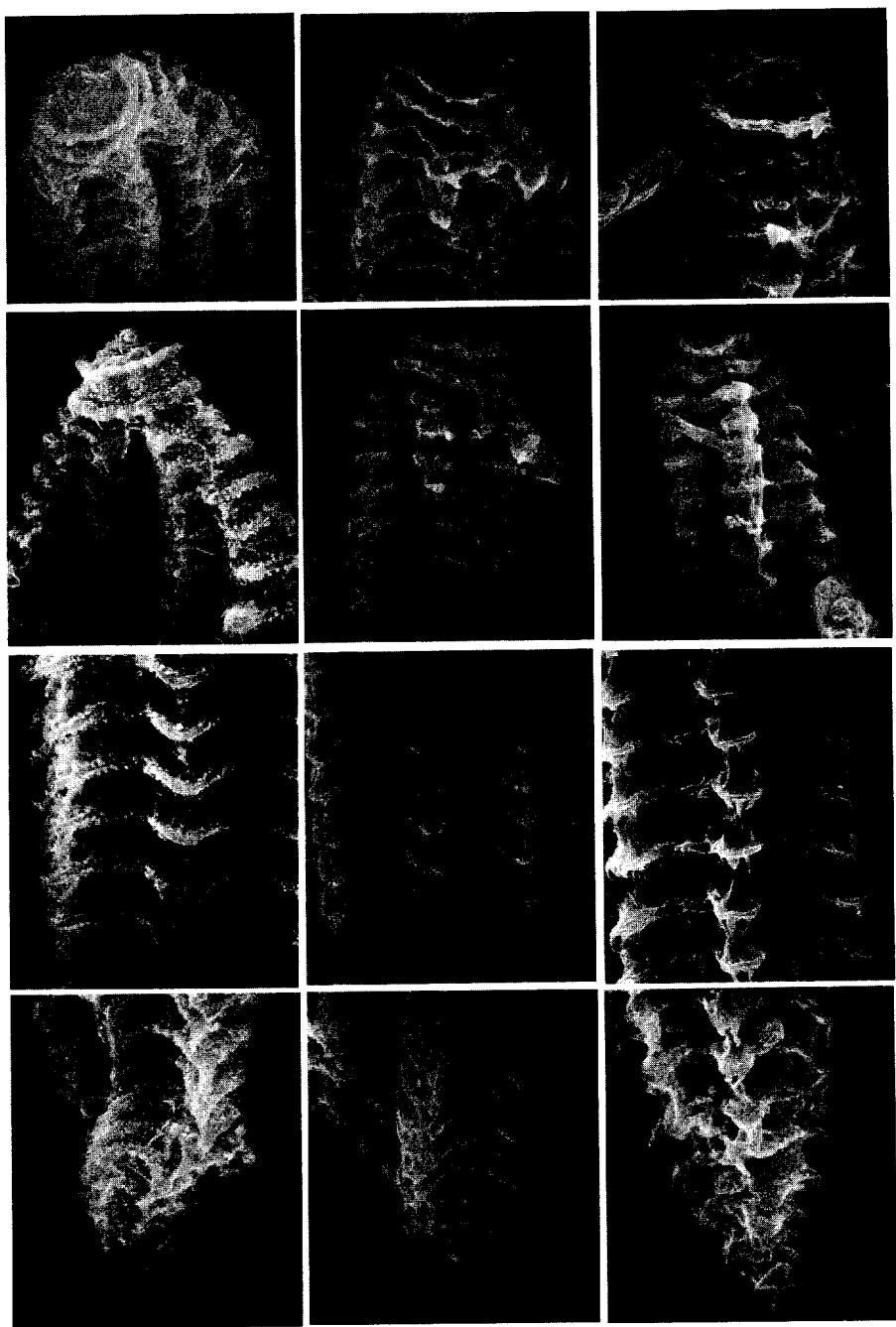


Figs. 325-336. *Ogyma* spp., third-stage juveniles. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 325. Face view, 326. Head, 327. Body scales, 328. Tail. *O. centone* (Mt. Eniwa, Hokkaido); 329. Face view, 330. Head, 331. Body scales, 332. Tail. *O. octozonale* (Nishinasuno, Tochigi); 333. Face view, 334. Head, 335. Body scales, 336. Tail. Scale bar indicates 3  $\mu$ m.

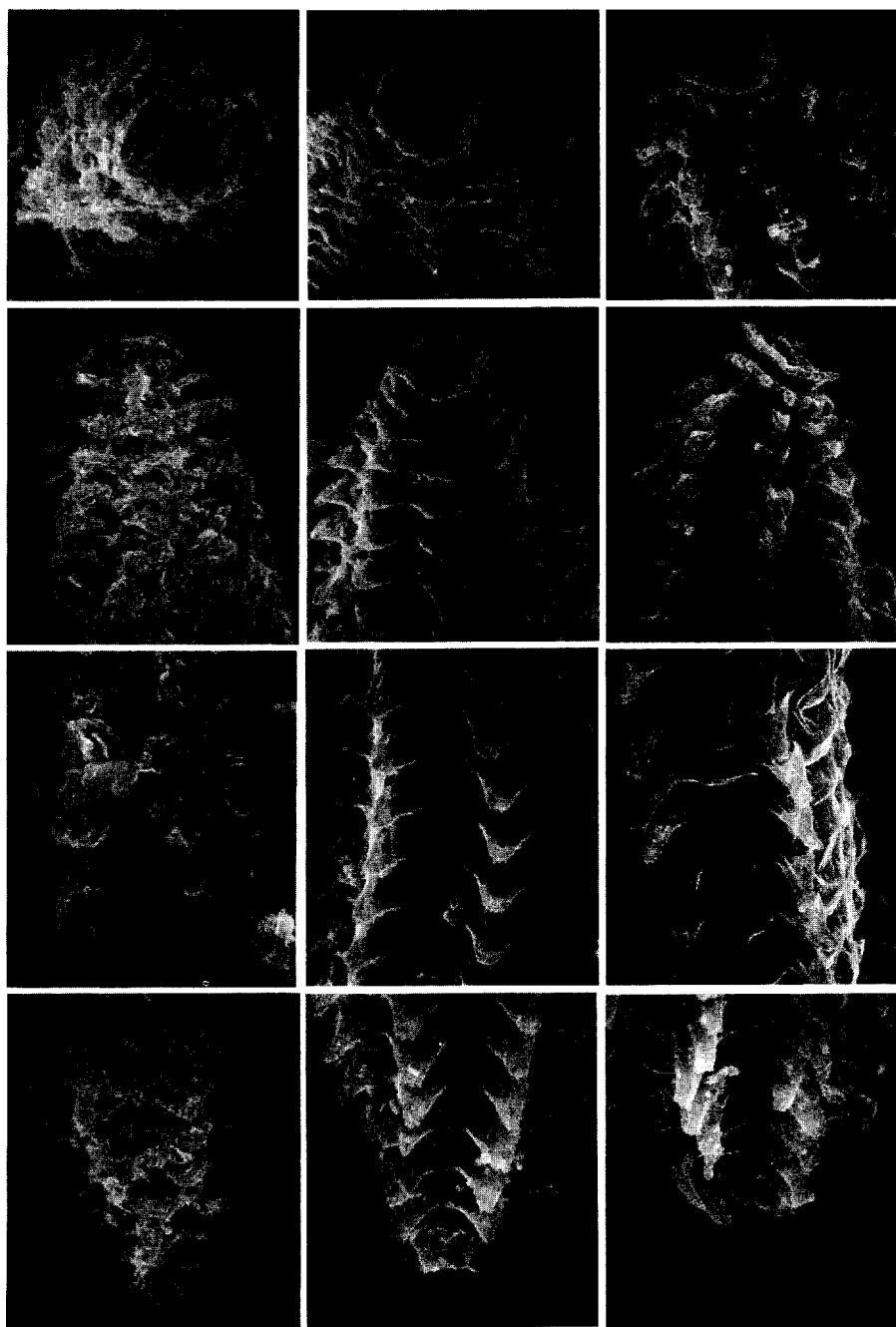


337	341	345
338	342	346
339	343	347
340	344	348

Figs. 337-348. *Ogma* spp., third-stage juveniles. *O. altum* n.sp. (Mt. Norikura, Nagano); 337. Face view, 338. Head, 339. Body scales, 340. Tail. *O. validum* n.sp. (Kunigami, Okinawa); 341. Face view, 342. Head, 343. Body scales, 344. Tail. *O. dryum* (Nishigoshi, Kumamoto); 345. Face view, 346. Head, 347. Body scales, 348. Tail. Scale bar indicates 3  $\mu$ m.

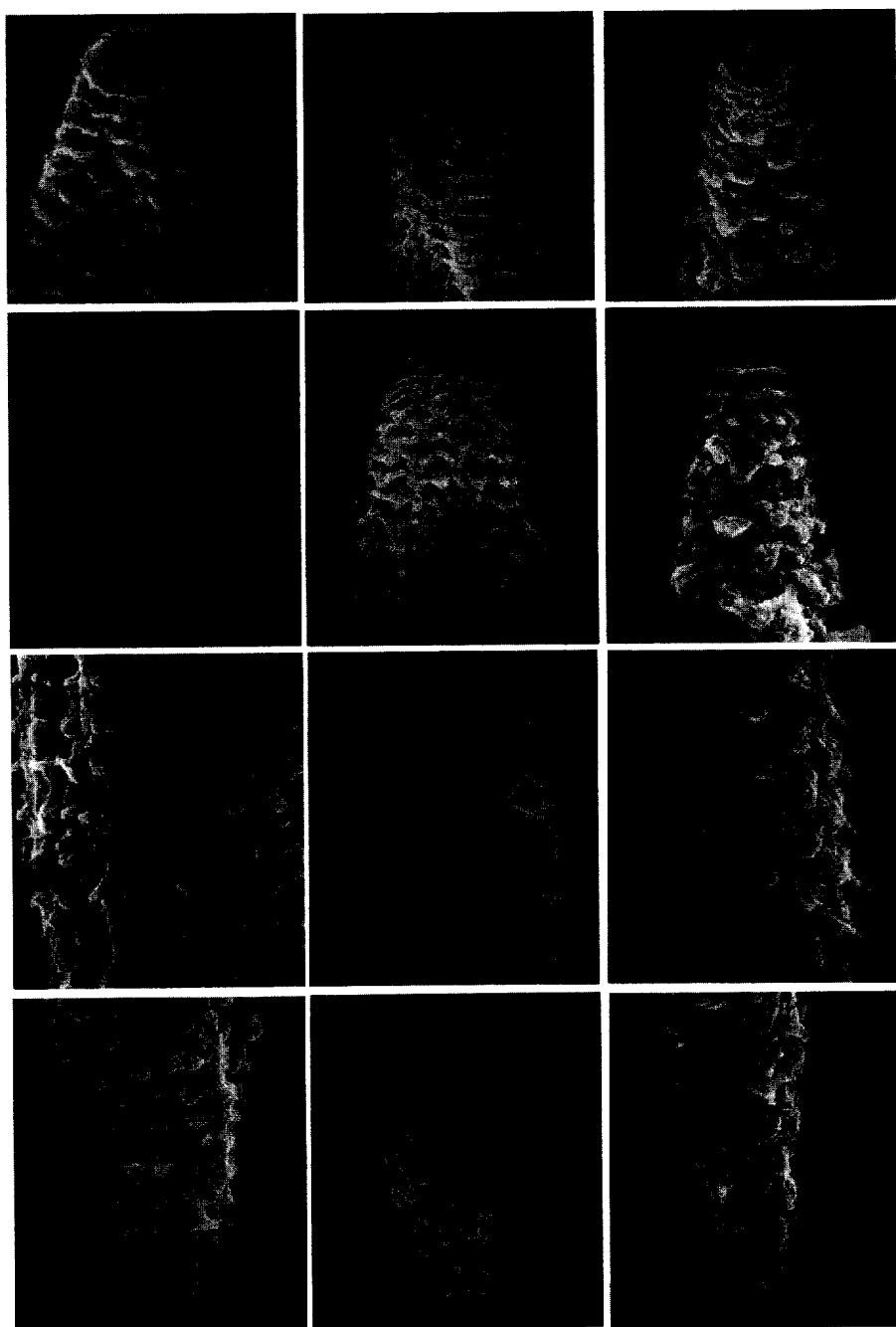


Figs. 349-360. *Oigma* spp., third-stage juveniles. *O. yambaruense* n.sp. (Kunigami, Okinawa); 349. Face view, 350. Head, 351. Body scales, 352. Tail. *O. abies* (Mt. Eniwa, Hokkaido); 353. Face view, 354. Head, 355. Body scales, 356. Tail. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 357. Face view, 358. Head, 359. Body scales, 360. Tail. Scale bar indicates  $3\mu\text{m}$ .

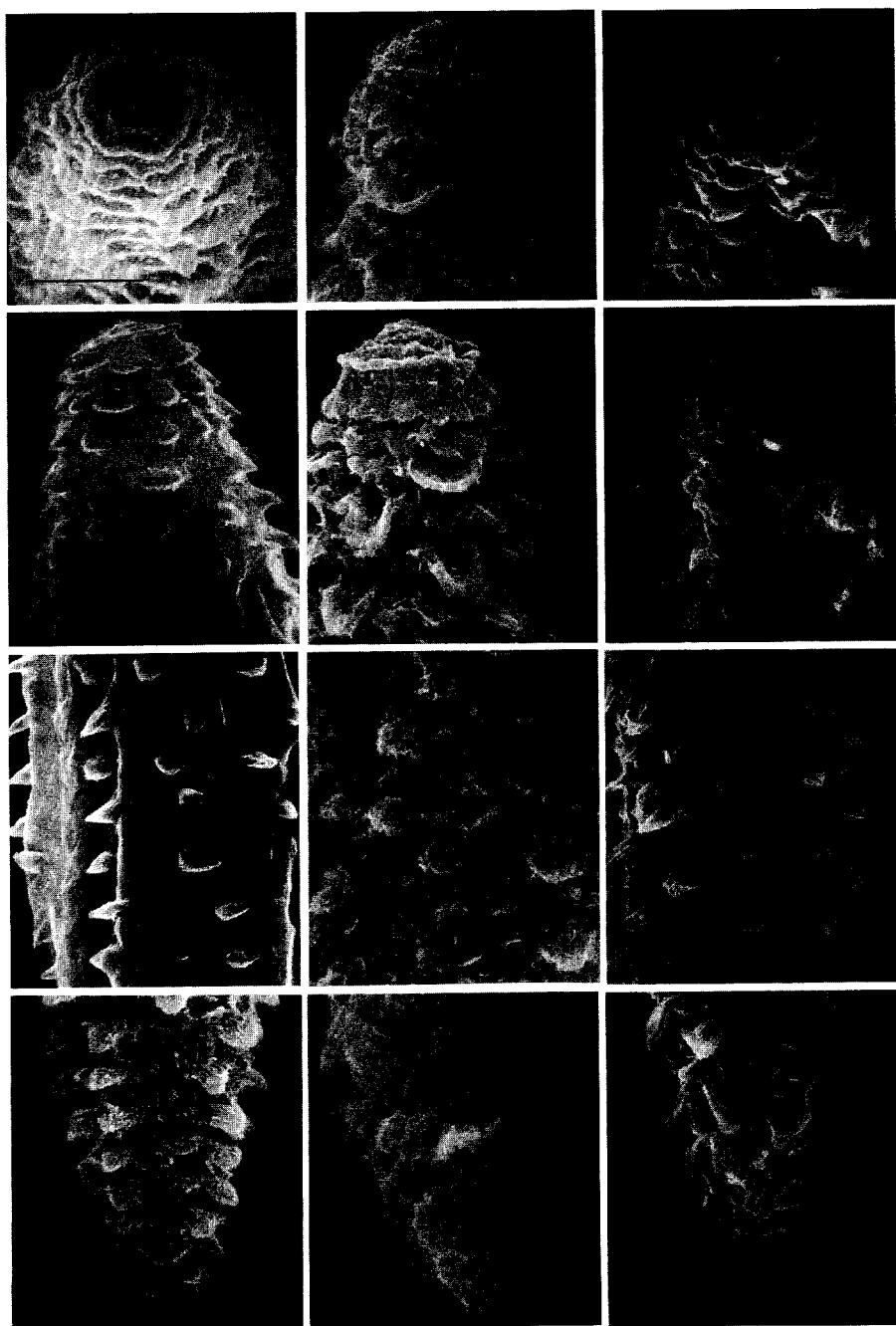


361	365	369
362	366	370
363	367	371
364	368	372

Figs. 361-372. *Ogma* spp., third-stage juveniles. *O. prini* n.sp. (Kunigami, Okinawa); 361. Face view, 362. Head, 363. Body scales, 364. Tail. *O. menzeli* (Sapporo, Hokkaido); 365. Face view, 366. Head, 367. Body scales, 368. Tail. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido); 369. Face view, 370. Head, 371. Body scales, 372. Tail. Scale bar indicates 3  $\mu\text{m}$ .

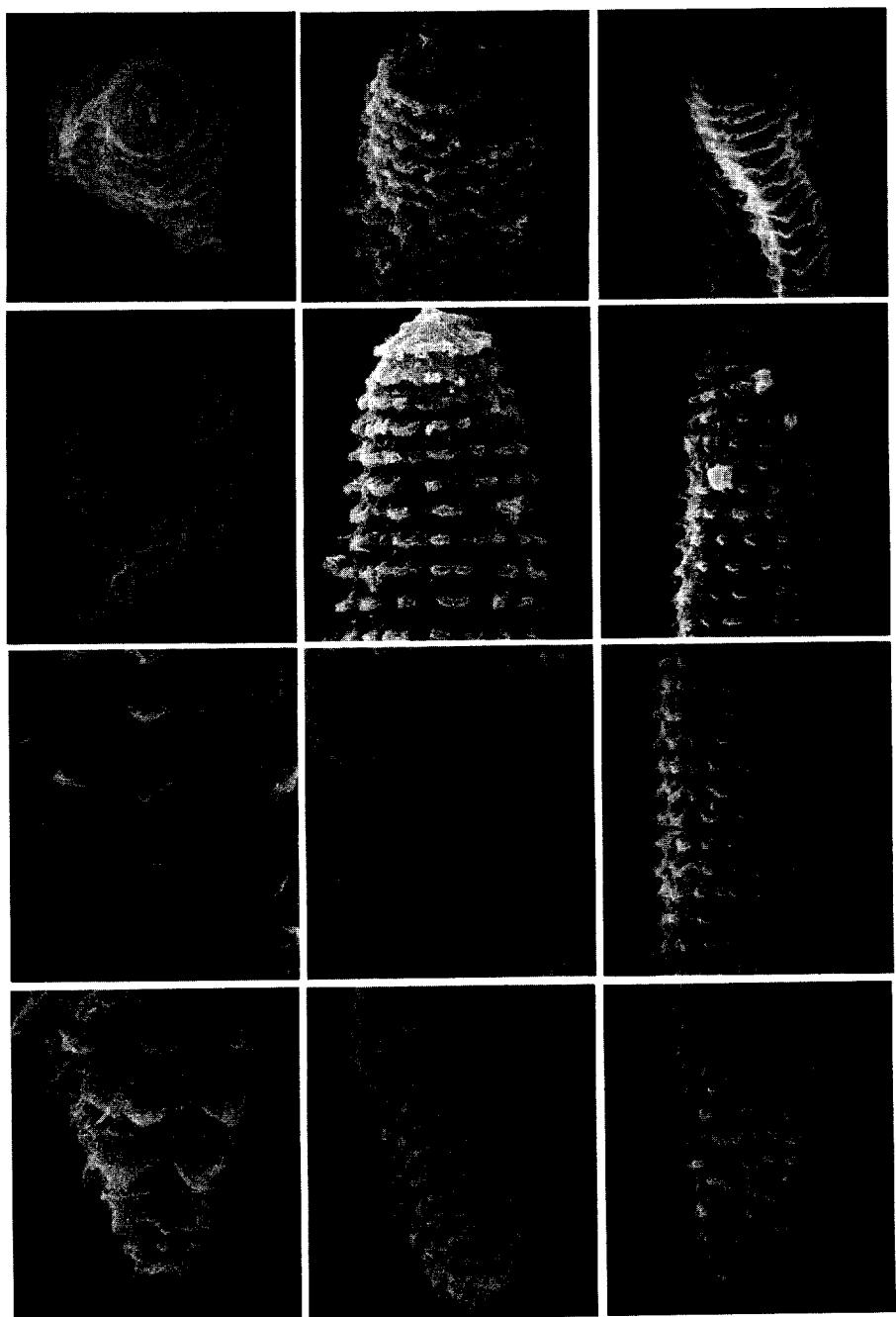


Figs. 373-384. *Ogma* spp., second-stage juveniles. *O. nemorosum* n.sp. (Mt. Norikura, Nagano); 373. Face view, 374. Head, 375. Body scales, 376. Tail. *O. centone* (Mt. Eniwa, Hokkaido); 377. Face view, 378. Head, 379. Body scales, 380. Tail. *O. octozonale* (Nishinasuno, Tochigi); 381. Face view, 382. Head, 383. Body scales, 384. Tail. Scale bar indicates 3  $\mu\text{m}$ .

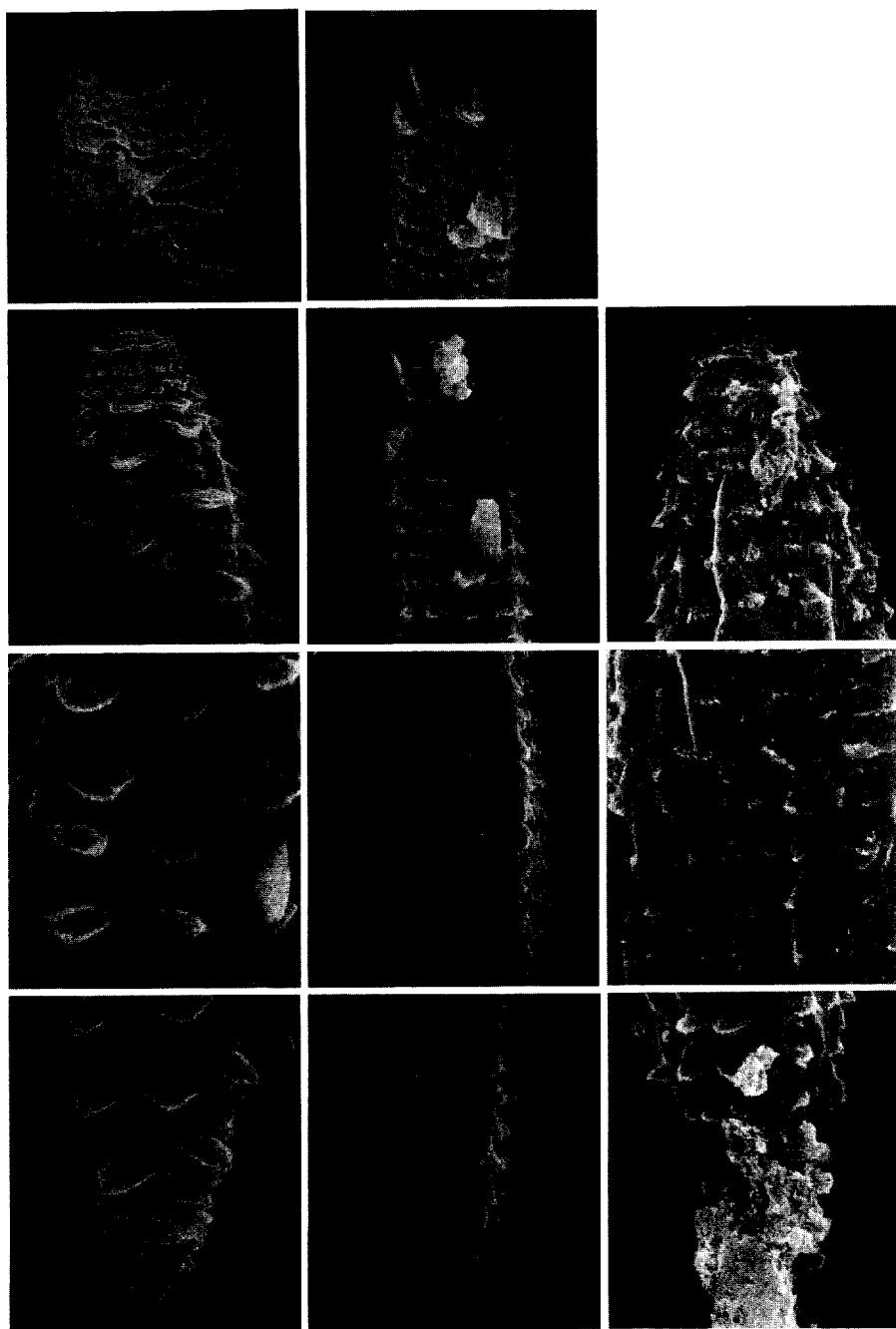


385	389	393
386	390	394
387	391	395
388	392	396

Figs. 385-396. *Ogma* spp., second-stage juveniles. *O. altum* n.sp. (Mt. Norikura, Nagano); 385. Face view, 386. Head, 387. Body scales, 388. Tail. *O. validum* n.sp. (Kunigami, Okinawa); 389. Face view, 390. Head, 391. Body scales, 392. Tail. *O. dryum* (Nishigoshi, Kumamoto); 393. Face view, 394. Head, 395. Body scales, 396. Tail. Scale bar indicates 3  $\mu\text{m}$ .



Figs. 397-408. *Ogma* spp., second-stage juveniles. *O. yambaruense* n.sp. (Kunigami, Okinawa); 397. Face view, 398. Head, 399. Body scales, 400. Tail. *O. abies* (Mt. Eniwa, Hokkaido); 401. Face view, 402. Head, 403. Body scales, 404. Tail. *O. segmentum* n.sp. (Tsukuba, Ibaraki); 405. Face view, 406. Head, 407. Body scales, 408. Tail. Scale bar indicates 3  $\mu\text{m}$ .



409	413	
410	414	417
411	415	418
412	416	419

Figs. 409-419. *Ogma* spp., second-stage juveniles. *O. prini* n.sp. (Kunigami, Okinawa); 409. Face view, 410. Head, 411. Body scales, 412. Tail. *O. menzeli* (Sapporo, Hokkaido); 413. Face view, 414. Head, 415. Body scales, 416. Tail. *O. microdorum* n.sp. (Mt. Sapporo, Hokkaido); 417. Head, 418. Body scales, 419. Tail. Scale bar indicates 3  $\mu$ m.